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DIVISION 9 - FINISHES

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SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Paint and finish all new exterior and interior exposed surfaces at the Springvale No. 4 Water Pump Station as specified herein, and as needed for a complete and proper installation, including but not limited as shown on Drawings.
- B. Conduct surface preparation as outlined herein and on the Drawings.
- C. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division I of these Specifications.
 - 2. Priming or priming and finishing of certain surfaces may be specified to be factory-performed or installer-performed under pertinent other Sections.
 - 3. Section 07920 Sealants, Caulking and Water Repellent Coatings
- D. Work not included:
 - 1. Unless otherwise indicated, painting is not required on surfaces in inaccessible areas.
 - 2. Metal surfaces of anodized aluminum, stainless steel, chromium plate, bronze, and similar finished materials will not require painting under this Section except as may be so specified.
 - 3. Do not paint moving parts of operating units; mechanical or electrical parts such as valve operators; linkages; sensing devices; and motor shafts, unless otherwise indicated.
 - 4. Do not paint over required labels or equipment identification, performance rating, name, or nomenclature plates.
- E. Definitions:
 - 1. "Paint," as used herein, means coating systems materials including primers, emulsions, epoxy, enamels, stain, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

- B. All coating preparation and application shall be performed by a Contractor with a minimum of five (5) years experience in working on similar projects. Upon request, Contractor shall supply five (5) successful project descriptions and references with contact information.
- C. Paint coordination:
 - 1. Provide finish coats which are compatible with the prime coats actually used.
 - 2. Review other Sections of these Specifications as required, verifying the prime coats to be used and assuring compatibility of the total coating system for the various substrata.
 - 3. Upon request, furnish information on the characteristics of the specific finish materials to assure that compatible prime coats are used.
 - 4. Provide barrier coats over non-compatible primers, or remove the primer and re-prime as required.
 - 5. Notify the Engineer in writing of anticipated problems in using the specified coating systems over prime-coatings supplied under other Sections.
 - 6. Apply paint of specified Dry Film Thickness (DFT), which thickness shall be absolute minimum coverage at any point of measurement.
- D. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 14 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. Product data sheets shall be provided for all paint to be utilized, and include but not be limited to:
 - a. Description
 - b. Typical use
 - c. Primer
 - d. Top coat
 - e. Surface preparation and profile
 - f. Finish
 - g. Solids by volume
 - h. VOC content
 - i. Theoretical coverage
 - j. DFT
 - k. Curing time
 - l. Performance criteria
 - m. Shipping and storage
 - n. Application and information
 - o. NSF approval (where required)
 - p. Safety data

3. Color cards.

C. Samples:

1. Following the selection of colors and glosses by the Engineer, as described under "Color Schedules" in Part 2 of this Section, submit Samples for the Engineer's review.
 - a. Provide three Samples of each color and each gloss for each material on which the finish is specified to be applied.
 - b. Except as otherwise directed by the Engineer, make Samples approximately 8" x 10" in size.
 - c. If so directed by the Engineer, submit Samples during progress of the Work in the form of actual application of the approved materials on actual surfaces to be painted.
2. Revise and resubmit each Sample as requested until the required gloss, color, and texture is achieved. Such Samples, when approved, will become standards of color and finish for accepting or rejecting the work of this Section.
3. Do not commence finish painting until approved Samples are on file at the job site.
4. Each style of pipe marker to be used in the Work.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.
- B. Comply with manufacturer's storage and handling instructions.

1.5 JOB CONDITIONS

- A. Do not apply solvent-thinned paints when the temperature of surfaces to be painted and the surrounding air temperatures are below 45° F, unless otherwise permitted by the manufacturers' printed instructions as approved by the Engineer.
- B. Weather conditions:
 1. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces, unless otherwise permitted by the manufacturers' printed instructions as approved by the Engineer.
 2. Applications may be continued during inclement weather only within the temperature limits specified by the paint manufacturer as being suitable for use during application and drying periods.

PART 2 - PRODUCTS

2.1 PAINT MATERIALS

- A. Acceptable materials:
 1. The Painting Schedule in Part 3 of this Section is based, in general, on products of Tnemec Company, Inc.

2. Equal products of, Rust-Oleum, Sherwin Williams, or other manufacturers approved in advance by the Engineer, may be substituted in accordance with provisions of the Contract.
 3. Where products are proposed other than those specified by name and number in the Painting Schedule, provide under the product data submittal required by Article 1.3 of this Section a new painting schedule compiled in the same format used for the Painting Schedule included in this Section.
- B. Undercoats and thinners:
1. Provide undercoat paint produced by the same manufacturer as the finish coat.
 2. Use only the thinners recommended by the paint manufacturer, and use only to the recommended limits.
 3. Insofar as practicable, use undercoat, finish coat, and thinner material as parts of a unified system of paint finish.
- C. Moisture mitigation products
1. Provide if directed by Owner, Engineer, or if moisture content is too high to apply coating system and project schedule may be delayed
 - a. Cast-in-place concrete
 - i) Provide moisture vapor reduction system as an undercoat
 - ii) Shall be compatible with all other provided coating systems, and as manufactured by Koster American Corporation, Virginia Beach, Virginia, Koster VAP I 2000 Fast Set (FS), or approved equal.
 - iii) Cure duration: 4-hours or less
 - iv) Perm rating: 0.05 grains/sf/hour in Hg⁻¹
 - v) Solids content: 100%

2.2 COLOR SCHEDULES

- A. The Engineer will prepare a color schedule from the approved manufacturer's color cards.
- B. The Engineer may select, allocate, and vary colors on surfaces throughout the Work.

2.3 APPLICATION EQUIPMENT

- A. For application of the approved paint, use only such equipment and procedures as is recommended by the manufacturer of the particular paint, and as approved by the Engineer.
- B. Prior to use of application equipment, verify that the proposed equipment is actually compatible with the material to be applied, and that integrity of the finish will not be jeopardized by use of the proposed equipment.

2.4 COLOR CODING (Pipes and Equipment)

- A. Color coding shall consist of standard color code painting as specified in this Section. All exposed pipelines for the transportation of chemicals (gas or liquid), potable and non-potable water including accessories such as valves, fittings and pipe coverings shall be painted.
- B. All hangers, pipe supports, braces, and floor stands, shall be painted with the same paint and color as the pipe it is supporting.
- C. The piping system shall be painted up to but not including the flange attached to the mechanical equipment.

2.5 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Prior to planning for painting, examine all surfaces to insure they are clean and dry, and in strict compliance with the paint manufacturer's surface preparation requirements.
- B. For concrete and masonry, a minimum of 28 days cure time is recommended prior to painting.
- C. Concrete must be dry prior to painting and testing such as taping polyethylene to surface to see if moisture accumulates shall be conducted.
- D. Ambient temperature shall be within the paint manufacturer's recommendations, prior to, during application and throughout curing period.
- E. On interior surfaces, relative humidity shall be controlled prior to, during application and throughout curing period.

3.2 MATERIALS PREPARATION

- A. General:
 - 1. Mix and prepare paint materials in strict accordance with the manufacturers' recommendations as approved by the Engineer.
 - 2. When materials are not in use, store in tightly covered containers.
 - 3. Maintain containers used in storage, mixing, and application of paint in a clean condition, free from foreign materials and residue.
- B. Mixing:
 - 1. Mix single and two-component paint to the manufacturer's recommendations.

2. Thin only to manufacturer's recommendations.
3. Mix only that portion of paint that can be easily applied within the pot life period as per the manufacturer's recommendations.
4. Do not stir into the material any film which may form on the surface, but remove the film and, if necessary, strain the material before using.

3.3 SURFACE PREPARATION: NEW EQUIPMENT AND MATERIALS

A. General:

1. Perform preparation and cleaning procedures in strict accordance with the paint manufacturers' recommendations as approved by the Engineer.
2. Remove removable items which are in place and are not scheduled to receive paint finish; or provide surface applied protection prior to surface preparation and painting operations.
3. Following completion of painting in each space or area, reinstall the removed items by using workmen who are skilled in the necessary trades.
4. Clean each surface to be painted prior to applying paint on surface treatment.
5. Remove oil and grease with clean cloths and cleaning solvent of low toxicity and flash point in excess of 200 degrees F, prior to start of mechanical cleaning.
6. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall onto wet, newly painted surfaces.
7. Conduct all surface preparation in strict compliance with all Local, State and Federal health, safety and Environmental Laws, Rules and Regulations.

B. Preparation of wood surfaces:

1. Clean wood surfaces until free from dirt, oil, and other foreign substance.
2. Smooth finished wood surfaces exposed to view, using the proper sandpaper.
3. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface.
4. Unless specifically approved by the Engineer, do not proceed with painting of wood surfaces until the moisture content of the wood is 12% or less as measured by a moisture meter approved by the Engineer.
5. All knots and pitch streaks shall be scraped, sanded and spot primed before full priming coat is applied. All nail holes, or small openings shall be caulked after priming coat is applied.

C. Preparation of metal surfaces:

1. Provide the manufacturer's published recommended surface preparation for the specified paint system unless a more stringent requirement is specified in this Section.
2. Structural steel shall receive a commercial blast cleaning in accordance with SSPC-SP#6.
3. Miscellaneous non-galvanized metals shall receive a power tool cleaning in accordance with SSPC-SP#3.
4. Galvanized metals shall receive a solvent cleaning in accordance with SSPC-SP#1 and hand cleaning in accordance with SSPC-SP#2.
5. All surfaces shall be free from dirt, oil or grease.

6. All edges, corners, crevices and welds shall receive special attention to insure that they receive the required surface preparation and DFT of paint.
- D. Preparation of concrete surfaces: Finish of concrete surface shall be as specified in Section 03345. Do not proceed with any paint preparation work until the specified finish is as specified.
1. Remove all chemical compounds, curing agents, surface hardeners, waxes, oils or other contaminants by sandblasting (SP-7). After sandblasting, remove all dust and grit and vacuum area.
 2. Smooth concrete surfaces exposed to view using proper techniques
 3. All form ties shall be ground down and grouted smooth.
 4. All imperfections and holes in the concrete surfaces shall be grouted and finished to provide a uniformly smooth surface prior to applying finishes.
 5. Concrete substrate shall be tested for moisture in accordance with paint manufacturer's requirements. Test results shall be submitted to Engineer.
 6. Apply coating as soon as possible after preparation.
- E. Preparation of proposed CIP floor slab:
1. All accessible concrete floor surfaces shall be mechanically cleaned using a "Blast-Trac" method or approved equivalent. All surface and embedded accumulations of toppings, hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be removed leaving a bare concrete surface having a minimum profile of 30 mils and exposing the upper facades of concrete aggregate. (Reference SSPC-SP13 / NACE 6, ICRI CSP 3-5)
 2. Floor areas that are inaccessible to the cleaning machine shall be mechanically abraded to the specified degree of cleanliness, soundness and profile using vertical disc scarifiers, starwheel scarifiers, grinders, needle guns or other suitable effective equipment.
 3. Allow the surface to dry or force dry with heat and circulating air to ensure that all surface, especially discontinuities, are visibly dry.
 4. All concrete floor terminations and leading edges shall be saw-cut and chiseled down to ¼ to ½" as to avoid feathered edge terminations. This includes drains, construction & expansion joints and all leading edges of concrete floor where they meet dissimilar materials.
- F. Preparation of new interior masonry (block walls)
1. Allow mortar to cure a minimum of 28 days.
 2. Level protrusions and mortar splatter.
 3. Block units shall be completely dry prior to painting. Areas in question shall be tested by duck taping sections of polyethylene to the underside of surfaces to see if moisture accumulates on sheet (ASTM D-4263).
 4. Clean units of all dust and other contaminants.
- G. Gas Piping and Fittings
1. Clean surface of all markings.

3.4 PAINT APPLICATION

A. General:

1. Apply prime, intermediate and finish coats of paint in strict compliance with the manufacturer's recommendations.
2. Apply prime and intermediate coats of paint before any equipment, panels, conduits, hangers, or the like are installed.
3. During application of paint, comply with all Local, State and Federal Health Safety and Environmental Laws, Rules and Regulations.
4. Utilize only methods and equipment as recommended by paint manufacturer.
5. Provide adequate ventilation during paint application.
6. Touch-up shop-applied prime coats which have been damaged, and touch-up bare areas prior to start of finish coats application .
7. Slightly vary the color of succeeding coats.
 - a. Do not apply additional coats until the completed coat has been inspected and approved.
 - b. Only the inspected and approved coats of paint will be considered in determining the number of coats applied.
8. Sand and dust between coats to remove defects visible to the unaided eye from a distance of five feet.
9. On removable panels and hinged panels, paint the backsides to match the exposed sides.

B. Primer

1. All priming shall be in compliance with the manufacturer's recommendations.
2. Surface preparation shall be completed and surfaces shall be clean and dry.

C. Drying:

1. Allow sufficient drying time between coats, modifying the period as recommended by the material manufacturer to suit adverse weather conditions.
2. Consider oil-base and oleo-resinous solvent-type paint as dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and when the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

D. Brush applications:

1. Brush out and work the brush coats onto the surface in an even film.
2. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.

E. Spray application:

1. Except as specifically otherwise approved by the Engineer, confine spray application to metal framework and similar surfaces where hand brushwork would be inferior.
2. Where spray application is used, apply each coat to provide the hiding equivalent of brush coats.
3. Do not double back with spray equipment to build up film thickness of two coats in one pass.

3.5 ITEMS TO BE PAINTED include, but are not limited to the following:

- A. New metals (Interior and Exterior)
 - 1. Pressed metal door and frame.
 - 2. All structural steel shapes (interior and exterior).
 - 3. Braces and hangers.
 - 4. Equipment which has a factory applied finish coat is not required to be painted, unless finish has been damaged.
 - 5. Gas piping
- B. New interior non-metal surfaces
 - 1. CMU Walls
 - 2. Concrete Ceiling
 - 3. Concrete Cap Beam
 - 4. Concrete Floor
- C. New exterior exposed surfaces
 - 1. CIP cap beam

3.6 PAINTING SCHEDULE

- A. Provide the following paint finishes.
 - 1. Structural Steel and Exterior Ferrous Metals:
 - a. Primer Series 90-97 Tneme-Zinc (3.5 Mils DFT)
 - b. Intermediate Series 27FC Typoxy (3.0 Mils DFT)
 - c. Finish Series 73 Endurashield (3.0 Mils DFT)
 - 2. Interior Ferrous Metals (Non-Galvanized):
 - a. Primer Series 37H Chem-Prime (2.5 Mils DFT)
 - b. Intermediate Series 66 Expoxoline (3.0 Mils DFT)
 - c. Finish Series 66 Expoxoline (3.0 Mils DFT)
 - 3. Galvanized Ferrous Metals:
 - a. Primer Series 27FC Typoxy (3.0 Mils DFT)
 - b. Finish Series 73 Endurashield (3.0 Mils DFT)
 - 4. New CIP Floor Slab
 - a. Finish Series 248 Everthane (3.0 Mils DFT)
 - 5. Interior CMU walls:
 - a. Block filler Series 1254 Epoxoblock (at recommended spreading rates)
 - b. Intermediate Series 27WB Typoxy (4.0-6.0 Mils DFT)
 - c. Finish Series 27WB Typoxy (4.0-6.0 Mils DFT)
 - 6. Interior precast ceiling and Cap Beam:
 - a. Primer Series 27WB Typoxy (4.0-6.0 Mils DFT)
 - b. Finish Series 27WB Typoxy (4.0-6.0 Mils DFT)

7. Interior Ferrous and Non-Ferrous Piping:
 - a. Primer Series 66 HB Epoxoline (2.5 Mils DFT)
 - b. Finish Series 66 HB Epoxoline (2.5 Mils DFT)

8. Exterior Concrete:
 - a. Primer Series 156 Enviro-Crete (6.0-8.0 Mils DFT)
 - b. Finish Series 156 Enviro-Crete (6.0-8.0 Mils DFT)

3.7 COLOR CODING AND PIPE MARKINGS

- A. Colors noted in the legend shall be picked from the approved manufacturer's color chart:

<u>Legend</u>	<u>Color</u>
Propane	Red
Raw Water (RW)	Marine Blue
Waste (W)	Light Brown

3.9 TOUCHUP

- A. Prior to request for final payment, Contractor shall touch-up all areas painted which have been damaged or permanently soiled.
 - 1.1 Contractor shall also touch-up paint on all equipment provided with finish coatings which may have been damaged in transport or installation.

END OF SECTION

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DIVISION 10 – SPECIALTIES

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SECTION 10521

PORTABLE FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide hand-portable fire extinguishers as required by the Contract Documents.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 60 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. Manufacturer's specifications, catalog cuts, and other data needed to demonstrate compliance with the specified requirements;
 - 3. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS

- A. Provide two (2), five (5) lb. BC rated carbon dioxide fire extinguishers.
 - 1. Seamless aluminum cylinder with a high gloss epoxy finish.
 - 2. Metal valve and pressure gauge.
 - 3. Standard wall mounting bracket for each extinguisher.

2.2 SIGNS

- A. Provide two (2) fire extinguisher signs equal to Series GSM8 as manufactured by Seton Name Plate Co., New Haven, CT.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install the work of this Section in strict accordance with the manufacturers' recommendations as approved by the Engineer, anchoring all components firmly into position.
- B. Install at the following locations confirmed by the Engineer:
 - 1. One unit installed in new electrical room next to door.
 - 2. One unit installed in existing electrical room.
- C. Provide certification that the extinguishers are fully charged and ready for service, at substantial completion of the Work.

END OF SECTION

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DIVISION 11 – EQUIPMENT

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SECTION 11215

VERTICAL TURBINE PUMPS AND APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide vertical turbine pumps and motor, with associated equipment as required by the Contract Documents.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 03300 Cast-in-Place Concrete
 - 3. Section 15060 Ductile Iron Pipe, Fittings and Appurtenances

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in installing vertical turbine pumps, gear drives and motors, with a minimum five (5) years documented experience.
- B. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. Pump and drive characteristic data including pump curves which indicate compliance with the specified requirements.
 - a. The pump curves shall consist of sheets showing GPM versus TDH for the bowls, the family of impeller curves and the H.P. The second sheet showing the GPM and the total TDH going through the design points and the total HP curve versus GPM, including efficiency.
 - 3. A complete parts list for all equipment furnished under this Section.
 - 4. Manufacturer's installation instructions.
 - 5. Manufacturer's operation and maintenance manuals.

- C. Comply with Section 01730 upon completion of the work and submit Operations and Maintenance Manuals.
- D. Certified pump curves: Prior to shipment of pump, testing shall be conducted at the factory and certified pump curves prepared at 50%, 75% and at design point indicating TDH versus GPM, HP versus GPM and efficiency versus GPM.
 - 1. Four copies of curves shall be submitted to Engineer for review.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 VERTICAL TURBINE WELL PUMPS

- A. Shall be multi-stage, semi-open impeller column discharge, water lubricated, turbine type, to operate at 1760 rpm.
- B. The specification has been written around Gould Pumps Model numbers 10HHC, and pumps manufactured by others with equal characteristics will be considered
- C. Pump Data:

Stages	Design Capacity Per Pump (gpm)	Minimum Shutoff Head (Ft)	Total Dynamic Head at Pump (Ft)	Minimum. Efficiency Design Capacity (%)
Pump No. 3	1,200	130	72.3	75

- D. Pump Elevations: See Contract Drawings for elevations.

2.2 PUMP BOWLS, SUCTION AND DISCHARGE CASES

- A. Shall be of close grained cast iron equivalent to ASTM A48, Class 30, without imperfections and shall be accurately machined and fitted to close tolerances.
- B. Bowl water passages shall be glass lined to provide optimum performance and consistency of output.
- C. Suction case and intermediate bowls shall be fitted with replaceable wear rings of bronze, ASTM B505 alloy 836.
- D. Bowls and cases shall have bronze sleeve type bushings to support and guide the shaft.

- E. Bushing material shall be bronze, ASTM B505 alloy 836.
- F. Suction case bearing shall be grease packed with provision for grease circulation from a reservoir in the suction case hub.
- G. Sand collar of rubber or bronze, ASTM B505 alloy 836 shall be provided to protect the suction case bearing from the abrasives in the liquid pumped.
- H. Discharge case shall have vanes to deliver the flow of water with minimum turbulence.
- I. The intermediate stages shall be selected to provide the maximum efficiency with the least number of stages.
- J. A suction piece shall be provided not to exceed 24-inches in length.

2.3 IMPELLERS AND BOWL SHAFTS

- A. Shall be of the semi-open type, cast of bronze, ASTM B584 alloy 836, accurately cast, machined, balanced, and filed for optimum performance and minimum vibration.
- B. The design shall be non-overloading for the capacity of the motors selected.
- C. Impellers shall be securely fastened to the bowl shafts with taper collets of ASTM A852, Grade 416 stainless steel.
- D. Bowl shafts shall be of sufficient diameter to transmit the pump horsepower with a liberal safety factor and rigidly support the impellers between the bowl or case bearings.
- E. Bowl shaft material shall be stainless steel of ASTM A582, type 416, and shall be precision turned, ground and polished, supported by water lubricated SAE660 bronze bearings.

2.4 COLUMN PIPE AND COUPLINGS

- A. Column pipe shall be of ASTM A53, grade A steel pipe.
- B. Ends shall be machined with 8 threads per inch with a 1/8-inch taper end face, paralleled to butt against machine shoulders in the column couplings.
- C. Intermediate sections of column shall not exceed 10 feet.
- D. Top and bottom sections of column pipe shall not exceed 5 feet.
- E. The upper end of bottom and intermediate column pipes shall be fitted with threaded sleeve type steel couplings.

- F. Bronze centering spiders of the drop-in type shall be furnished for shaft stabilization at each coupling.
- G. The line shaft bearings shall be of fluted rubber retained in spider by a shoulder on each end of bearing.

2.5 DISCHARGE HEADS

- A. Shall be a suitable pump head of high-grade cast iron ASTM A48, class 30.
- B. Shall be provided for mounting the gear drive unit and supporting the pump column, bowls and suction pipe.
- C. The outlet shall be 125 pound ANSI B16.1 standard flat faced flange.
- D. Above ground discharge shall be equipped with a separate steel sub-base plate, furnished under Miscellaneous Metals to the dimensions shown on the Drawings.
- E. The discharge head shall be constructed with a vertical vane for reduction of turbulence.

2.6 DRIVE SHAFT AND STUFFING BOX

- A. Drive shafts shall be of stainless steel ground and polished with a surface finish not to exceed 40 rms.
- B. The design shall permit the drive shaft to be coupled above the stuffing box to facilitate easy removal and replacement of the driver.
- C. Drive shall extend through to the top of the motor, transmitting the pump thrust to the motor upper bearing surface.
- D. Cast iron stuffing box shall be of the deep bore type with a minimum of six rings of packing and a seal cage.
- E. Connections for grease inlet and pressure relief shall be provided.
- F. The stuffing box assembly shall be equipped with a 2-inch pre-lubrication tap.
- G. Packing gland shall be the bronze split type and secured in place with ASTM A193, grade B8 stainless steel studs and silicon bronze nuts.
- H. Stuffing box bearing shall be SAE660 bronze.
- I. A rubber slinger shall be secured to shaft above packing gland.

2.7 LINE SHAFTS AND LINE SHAFT BEARINGS

- A. Line shafts shall be ASTM A276 Grade 416 stainless steel ground and polished with a surface finish not to exceed 40 rms.
- B. Shaft diameter shall be of ample size to operate pump without vibration or distortion, with selection based on a combined shear stress of not more than 18% of the ultimate strength or not in excess of 30% of the elastic limit in tension. Minimum shaft diameter is one and one half (1 ½) inches.
- C. The exterior pump shaft and top drive shaft shall not exceed 5-feet in length.
- D. Intermediate shaft sections shall be interchangeable and shall not exceed 10-feet in length.
- E. The butting ends shall be machined square to the axis of the shaft.
- F. Faces shall be recessed to thread and designed with a safety factor of 1-1/2 times the shaft safety factor.
- G. Threads shall be left hand to tighten during pump operation.
- H. Couplings shall be stainless steel.

2.8 MOTORS

- A. Motor shall be high thrust (175%) heavy duty induction type, inverter duty for VFD operation, NEMA Design B, vertical hollow shaft design.
- B. Shall operate on 3 phase, 60 cycle, 460 volt power.
- C. Shall be manufactured by General Electric, U.S. Electrical Motors or other manufacturer of equal standard.
- D. Motor data: Motor Horsepower 40, speed 1760 RPM
- E. Shall have service factor 1.15, continuous, 40°C. ambient, high-thrust, Class F insulation, energy efficient, NEMA nominal 94.2%.
- F. Motor shall include a non-reverse ratchet to prevent reverse rotation of rotating elements.
- G. Motor shall be manufactured with a suitable thrust bearing in upper end adequate to receive entire hydraulic thrust load of pump unit plus weight of rotating parts under all conditions of operation, including shut off condition.
- H. Motor frame size shall be of standard configuration sized to be compatible with the discharge head.

2.9 AIR LINE TUBING

- A. Shall be 3/8-inch diameter polyethylene attached to the pump column and connected to a Shraeder air valve and fittings anchored to discharge with well level gauge displaying length of tube and well level with all fittings and couplings as shown on the Drawings, including a water tight connection at pump sub-base plate.

2.10 CONCRETE BASES

- A. Concrete shall be as specified in Section 03300.

2.11 ANCHORING SYSTEM

- A. Shall be HVA Adhesive Anchor System by Hilti, Corp., Liebig Adhesive Anchor by Liebig International, Inc. or an equal.
 - 1. Anchor rod assembly shall be 7/8-inch stainless steel
 - 2. Adhesive anchor shall be the cartridge type.
- B. Hardware such as nuts and bolts used in pump assembly, discharge head mounting, gear drive and motor mounting shall be stainless steel.

PART 3 - EXECUTION

3.1 DISINFECTION OF EQUIPMENT

- A. Contractor shall supply a disinfection barrel on the job site and maintain a solution of 200 ppm chlorine for disinfection of equipment to be utilized in the well.
- B. Three pounds of calcium-hypochlorite (65% available chlorine) in a water solution shall be placed in the well as the well and the pump is installed.
- C. All surfaces above the static water level shall be flushed or washed with the sterilizing solution.
- D. Following the installation of the pump, the well shall be left in static condition for a minimum of four (4) hours.
- E. Following the four (4) hour period, the well shall be pumped to waste until the discharge contains a chlorine concentration of less than 1 ppm (mg/l).

3.2 INSTALLATION

- A. Existing Wells
 - 1. Existing well casings shall be cut to the elevations indicated on the drawings, and temporarily capped to prevent entrance of undesirables or contamination.

2. Observation wells shall be adjusted in location and height as indicated on the Contract Drawings, or as directed by Engineer.
- B. Concrete Base Pads
1. Concrete base pads shall be formed and anchored to floor slab, to the dimensions shown on the Drawings, and to the height to match equipment provided.
 2. A circular form sized to match well casing shall be utilized to carry well to surface of pad.
 3. Pad shall be smooth and level on top.
- C. Access Tubes
1. Access tubes shall be fabricated from 2-inch steel pipe and welded to casing as shown on Drawings.
 2. All surfaces shall be ground smooth, especially the interior of well casing to prevent entanglement of water level measuring equipment upon removal.
 3. A 2-inch vent cap shall be provided on one tube and a threaded cap on the second.
- D. Pump
1. Pump shall be carefully placed in well by a subcontractor with a minimum 5 years experience specifically in installation of vertical turbine pumps.
 2. Pump shall be centered in well and plumb.
- E. Discharge Head
1. Sub-base plate shall be installed upon a bed of non-shrink mortar and anchored in place level and centered over well.
 2. Discharge head shall be connected to column and anchored to sub-base plate.
- F. Motor
1. Motor shall be carefully placed over drive shaft without exerting any lateral pressure, lowered into position and connected.
- G. Adjustments
1. Pump sub-contractor shall make adjustments to vertical turbine pumping unit to manufacturer's tolerances.
- H. Minor Piping
1. Piping for pump seal drain shall be provided.
- I. Disinfection of Well
1. Contractor shall disinfect well prior to performance testing with a solution of calcium or sodium hypochlorite and pump to waste.
 2. Contractor shall properly discharge solution to waste until chlorine concentration is non-detectable, collect a sample and submit same to a State Certified Laboratory for coliform analyses.
 3. If presence of coliform bacteria is detected, disinfection and testing shall be repeated.

J. Performance Test

1. The Contractor shall provide the services of the vertical turbine sub-contractor for the performance testing.
2. The pumping unit shall be run for a period of time to observe operational characteristics such as vibration and noise.
3. The pumping unit, gear drive and motor shall operate without vibration or excessive noise, and the proper adjustments shall be made to insure this requirement is achieved.
4. The units shall be checked for heat buildup in the bearing areas and seal unit, with the voltage, amps and rpm of motor checked for compliance with manufacturer's standards.
5. A pump performance test shall be performed, operating at one-half discharge rate, full discharge and at shut off condition, with data plotted upon the certified pump curve and a report indicating data such as discharge rate, amps, units, pressure water level in well, motor vibration readings, etc. shall be submitted in triplicate.

END OF SECTION

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DIVISION 12 – FURNISHINGS

<u>Section</u>	<u>Subject</u>	<u>Page</u>
12693	Floor Mats	12693-1 thru 12693-2

SECTION 12693

FLOOR MATS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide switchboard floor matting as required by the Contract Documents.
- B. Related work:
 - 1. Documents affecting work of this Section, include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 FLOOR MATTING

- A. Switchboard matting: Shall be as supplied by Grainger, McMaster-Carr or an approved equal.

1. Thickness - 1/4 inch
2. Width - 36 inches
3. Surface – corrugated
4. Nominal Use Voltage - 17,000 volts
5. Material – rubber
6. Comply with ASTM D-178

B. Provide the following:

1. One ten (10) foot length

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Place in areas as directed by the Engineer. Weigh down any edges which do not lay flat until they do lay flat.

END OF SECTION

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DIVISION 13 - SPECIAL CONSTRUCTION

<u>Section</u>	<u>Subject</u>	<u>Page</u>
13310	Instrumentation	13310-1 thru 13310-5

SECTION 13310

INSTRUMENTATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide all instrumentation, controls, wiring and cables as required by the Contract Documents.
- B. In general, the proposed work shall include the following:
 - 1. Furnish and install new well water level transducer.
 - 2. Furnish and install new magnetic flow meter and remote indicator.
 - 3. Well level display.
 - 4. Tank level transmitter.
 - 5. Strap on flow sensor.
- C. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Division 16 Electrical
- D. Related work not included:
 - 1. Power wiring and all conduit runs shown on the Drawings shall be provided under Division 16 unless specified otherwise.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
3. Point to point wiring diagrams
4. Input-output characteristics
5. Range, size and graduation
6. Physical size, dimensions and mounting details and requirements
7. Materials of construction
8. Certified calibration data on all flow metering devices
9. The name, address and phone number of the local authorized service facility for each piece of equipment shall be shown.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

1.5 COORDINATION

- A. Coordinate the Work of this Section with Division 16 or any other Sections which require equipment or device locations or which interface with the work of this Section.

PART 2 - PRODUCTS

2.1 WELL LEVEL MEASUREMENT EQUIPMENT

- A. Level transducer shall be equal to Model SST submersible level transducer as manufactured by Ametek.
 1. Housing 316 stainless steel
 2. Cable Kevlar members to prevent errors from cable elongation
 3. Vent tube Including 8" desiccant if required by sensor
 4. Range 0 – 69.2 Feet
 5. Accuracy +/- 0.05% FS
 6. Output 4 – 20 MADC
 7. Cable Integral cable, sufficient in length to connect transducer to meter without a splice.
Estimated length is 115-feet

2.2 WELL LEVEL METER

- A. Provide well level meter equal to Level Mate III Model LM SB31 manufactured by Ametek, Inc. with the following attributes:
 1. Power 120 VAC
 2. Display LED 6 digit numeric display
 3. Marking Feet
 4. Calibration On board
 5. Range 0-69.2 – feet
 6. Output Isolated 4-20 mA

- | | | |
|----|--------------|----------------------|
| 7. | Display size | ½-inch number height |
| 8. | Sensor panel | 24 VDC from meter |
| 9. | Surge | AC in; DC in and out |

2.3 MAGNETIC FLOW TUBE

- A. Magnetic flow meter on station discharge to be sized at 8-inch diameter.
1. Flow meter shall be Krohne Optiflux 4000 with the following attributes:

a.	ANSI pipe flanges	B16.5 Class 150 lb., raised
b.	Electrode design	Flat elliptical electrodes
c.	Protection category	NEMA 6
d.	Measure tube	Hard rubber
e.	Electrodes	Hastelloy C4
f.	Grounding rings	SS 316 Ti
g.	Range	0-1,000 GPM
h.	Terminal box	Potted for submergence rating
 2. Flow meter to include a signal converter Krohne IFC-020F, remote version with the following attributes:

a.	Version	Display with 3-line CD
b.	Current output	0-20mA or 4-20mA
c.	Power supply	115 volts
d.	Power consumption	8 VA
e.	Housing	Polycarbonate NEMA 4X
f.	Cable length	Minimum 30 feet (Contractor to confirm)
- B. Flow meter cables from signal converter to measuring sensor:
1. Signal cable to be shielded 3-wire insulated copper cable.
 2. Current cable to be shielded 3-wire insulated copper cable.
 3. PVC cable insulating tubing for drain wires.
 4. Heat shrinkable tubing for sealing prepared cable ends.
 5. Wire and ferrule to DIN 46228 for drain and conductors.

2.4 TANK LEVEL PRESSURE TRANSDUCER

- A. Level transducer shall be equal to Series 351 submersible level transducer as manufactured by KPSI.
- | | | |
|----|-----------|---|
| 1. | Housing | 316 stainless steel |
| 2. | Cable | Polyurethane |
| 3. | Vent tube | Including bellow for condensation protection |
| 4. | Range | 0 – 30 Feet (0-13 psi approximately) |
| 5. | Accuracy | +/- 0.01 ft. H2O |
| 6. | Output | 6-28V-VDC |
| 7. | Cable | Integral cable, sufficient in length to connect transducer to indicator panel in Tonka WTP without a splice. Estimated length is 320-feet |

- B. If transducer manufacturer cannot provide the required continuous cable length, the splice will be allowed in an above ground box at the base of the tank.

2.5 REUSE TANK FLOWMETER

- A. The flowmeter shall be a strap-in type series DCT088, Dedicated Transit Time Flowmeter as manufactured by Thermo Fisher Scientific or an approved equal.
 - 1. Shall have a velocity range +/-0 m/s to +/-15 m/s.
 - 2. Accuracy of +/-0.5% of velocity.
 - 3. Pipe Size: 25.4 mm to t m.
 - 4. Transmitter: IP65, flame retardant, fiberglass reinforced polyester NEMA 4X.
 - 5. Transducer: Two (2) encapsulated transducers suitable for submersion or underground service.
 - 6. Cable length to be 300 linear feet to avoid splices.
 - 7. Outputs 4-20 mA, 12-bit, 5 kV, opto-isolated, loop or self-powered, RS 232 serial interface.
 - 8. Power supply: 90 to 132 VAC or 190 to 250 Vac, 50/60 Hz, 12 to 24 Vdc; Data logger: 30,000 point data logger, programmable in 1-second intervals.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction.
- B. The installation and mounting of all components of the instrumentation system furnished under this Section, unless otherwise stated, shall be performed under the work of this Section.
 - 1. All mounting hardware, brackets, pipe supports and piping necessary for the installation of the components of this Section shall be provided by this Section.
 - 2. All necessary signal cable and terminations to provide an operational system.
- C. Work required to install flow meter remote indicator in Springvale No. 4, power and signal conductors shall be completed under Division 16.
- D. Work required to install tank level transducer and reuse flowmeter shall be completed under Division 16.

3.2 TESTING

- A. Following installation of all instruments, meters, monitoring and control devices, the Contractor shall arrange a site visit by the manufacturer's technicians who are qualified technicians capable of testing and servicing the equipment.
1. Site visit by technicians shall include inspection of all connections, power up of equipment, testing and calibrating equipment.
 2. Technicians to furnish start up and calibration reports for each piece of equipment.
 3. Technician shall conduct a training session for the operators on each instrumentation device.

END OF SECTION

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DIVISION 14 - CONVEYING SYSTEMS

(OMITTED)

Section

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DIVISION 15 - MECHANICAL

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15064	Plastic Pipe and Fittings	15064-1 thru 15064-3
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SECTION 15060

INTERIOR PIPING, FITTINGS AND APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide all the flanged ductile iron pipe, fittings and appurtenances as required by the Contract Documents.
- B. Related Work:
 - 1. Documents affecting work of this Section, include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 09900 Painting
 - 3. Section 15094 Pipe Hangers and Supports
 - 4. Section 15100 Valves and Appurtenances

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. All ductile iron pipe and fittings shall be of domestic manufacturer.
- C. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 14 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Shop drawings showing piping layouts, dimensions, location of supports and braces, interface with piping and equipment furnished under other Sections of this Specification.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE

- A. Interior Use
 - 1. Shall have dimensions wall thicknesses and flanges in accordance with ANSI/AWWA C115/A21.15 or latest revision thereto. Pipe shall be Class 53 with maximum working pressure of 250 PSI.
 - 2. Wall thickness and flanges shall comply with ANSI/AWWA C115/A21.15.

2.2 FASTENERS

- A. Bolts and studs
 - 1. Shall conform to ASTM A307, Grade B.
- B. Nuts
 - 1. Shall conform to ASTM A563, Grade A heavy hex.

2.3 COATINGS

- A. Exterior
 - 1. A coating of red oxide primer compatible with the coatings specified in Section 09900.
- B. Interior
 - 1. Shall be cement lined meeting the requirements of ANSI/AWWA C104/A21.4-85, or latest revision thereto.

2.4 GASKETS

- A. Gaskets shall be full face rubber, 1/8 inch thick.

2.5 DUCTILE IRON FITTINGS

- A. Interior use
 - 1. Fittings shall be manufactured of ductile iron or gray iron, flanged joint design rated for 250 psi.
 - 2. Fittings shall meet or exceed the requirements of ANSI/AWWA C110/A21.10, or latest revision thereto.
 - 3. All fittings shall have tapping bosses (both sides) and on each branch.
 - 4. Bolts, studs and nuts shall be as specified above.
 - 5. Exterior and interior coating as specified above.

2.6 FILLER FLANGES

- A. Filler flanges and beveled filler flanges shall be furnished and installed as required. Filler flanges and beveled filler flanges shall be furnished faced and drilled complete with extra length bolts.

2.7 PIPE COUPLINGS

- A. Pipe couplings shall be as manufactured by Dresser Industries Inc., Bradford, Pennsylvania or an approved equal with the following attributes:
 - 1. Gasketed sleeve type
 - 2. Diameter sized to fit pipe
 - 3. Grade 27 (Buna-N blend) wedge section gaskets
 - 4. Steel followers
 - 5. Steel middle ring
 - 6. Stainless steel nuts and bolts

2.8 TIE RODS

- A. Provide 7/8-inch diameter stainless steel tie rods with necessary nuts and washers where shown on the Drawings.

2.9 PIPE TO WALL SEAL

- A. Provide mechanical type seal for watertight seal between concrete wall cored opening and discharge pipe.
- B. Seal to be equal to "Link Seal" as manufactured by Thunderline Corp.
- C. Bolts and nuts to be stainless steel.

2.10 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until satisfactory conditions are corrected.

3.2 FIELD MEASUREMENTS

- A. Make necessary measurements to assure precise fit of piping system.

3.3 COORDINATION

- A. Coordinate the work of this Section with pump supplier to insure all dimensions and elevations are compatible.

3.4 INSTALLATION

- A. Interior Ductile Iron Pipe Fittings and Appurtenances:
 - 1. Wall openings shall be of the proper size for all pipes passing through the walls, as shown on the Drawings.
 - 2. All piping and fittings shall be installed true to alignment and rigidly supported.
 - 3. Each pipe and fitting shall be cleaned out before assembly.
 - 4. Piping shall be installed in accordance with the approved piping as shown on the drawings.
 - 5. Protect pipe and fittings during handling against shocks and free fall.
 - 6. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, a certification shall be submitted stating that such requirements have been complied with.

3.5 TESTING

- A. Pressure Piping System
 - 1. Interior piping shall be tested at a hydro static test pressure of 100 psi for a minimum time of one (1) hour.
 - 2. If leaks are discovered they shall be repaired under this Section.
 - 3. Provide miscellaneous blank flanges and bracing as required to isolate piping system from equipment during the test period.

3.6 DISINFECTING

- A. All piping and fittings installed under this Section shall be chlorinated before being placed into service.
 - 1. Lines shall be chlorinated in accordance with the applicable sections of ANSI/AWWA C601.
 - 2. Provide temporary piping, valving and pumping for blow-off if required.
 - 3. Approval of the disinfecting procedure, by the Owner, shall be required before proceeding.
 - 4. Samples and testing for total coliform shall be taken by Owner. The Contractor shall assist, if necessary, to obtain the samples.
 - 5. Retesting, if necessary, shall be paid for by the Contractor.

END OF SECTION

SECTION 15064

PLASTIC PIPE AND FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Sump pump discharge piping, polyvinyl chloride (PVC) piping, fittings and appurtenances as required by the Contract Documents.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. The Drawings are diagrammatic and indicate the general arrangement of systems and work included. Information and components shown on isometric but not shown in plan view or vice versa, shall apply or be provided as if shown on both. It is not intended to specify or to show every offset, fitting, or component; however, it is the intent of these Specifications and Drawings that all required components and materials, whether or not indicated or specified, shall be provided in such a manner as to make the entire piping installation fully complete and operational in all respects.
- C. Codes and regulations:
 - 1. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies having jurisdiction.
 - 2. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern.
- D. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within fifteen (15) calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section;
2. Manufacturer's specifications, catalog cuts, and other data needed to prove compliance with the specified requirements;
3. Shop drawings showing piping layout, methods, and locations of supports and hangers and connections to equipment.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) PIPE

- A. Plastic pipe shall be manufactured from rigid unplasticized polyvinyl chloride compounds that comply with the pertinent sections of ASTM-D1784 for Class 12454-B.
 1. Pipe shall be manufactured in accordance with ASTM-D1785, PVC 1120.
 2. Shall be of the sizes shown on the Drawings and shall be Schedule 80.

2.2 POLYVINYL CHLORIDE (PVC) FITTINGS

- A. Socket Type
 1. Shall be socket type for solvent welded joints.
 2. Shall conform to ASTM-D2467.
 3. Joints shall be flanged where shown on the Drawings and have 1/8 inch full face gaskets. Flange nuts and bolts shall be type 304 stainless steel.
 4. Fittings, specials, unions, and flanges shall be of the same schedule number as the pipe they are attached to.

2.3 SOLVENT CEMENT

- A. Cement for PVC pipe and fittings:
 1. Shall meet or exceed the requirements of ASTM-D2564.

2.4 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PIPING SYSTEM LAYOUT

- A. Follow the general layout shown on the Drawings in all cases except where other work may interfere.
- B. Perimeter drain shall be laid at a constant gradient around the perimeter of the building foundation .

3.3 INSTALLATION

- A. Chlorinated Polyvinyl Chloride (CPVC) Piping Systems.
 - 1. The installation of plastic pipe shall be strictly in accordance with the manufacturer's technical data and printed instructions.
 - 2. Joints for plastic pipe shall be solvent welded except flanged or threaded where required. In making solvent welded connections, clean dirt and moisture from pipe and fittings, bevel pipe ends slightly with emery cloth, if necessary, and apply solvent cement of the proper grade. Solvent welded joints shall be made in accordance with ASTM-D2855.
 - 3. Installation of valves and fittings shall be strictly in accordance with manufacturer's instructions. Particular care shall be taken not to over-stress threaded connections. In making solvent weld connections, the solvent shall not be spilled on valves or allowed to run from joints.
 - 4. All piping shall have a sufficient number of unions to allow convenient removal of piping and shall be as approved by the Engineer.
 - 5. Plastic pipe to metal pipe connections shall be made with flanged connections. Do not thread metal pipe into plastic fittings, valves or couplings nor shall plastic piping be threaded into metal fittings, valves or couplings. Use socket to thread adaptors for threaded connections.

END OF SECTION

SECTION 15094

PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide pipe supports, including in general, all metallic hanging and supporting devices for supporting piping, unless noted on the Drawings or specified herein otherwise.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 15060 Interior Piping, Fittings and Appurtenances

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Hangers and supports shall be of an approved standard design capable of supporting the load under all operating conditions.
- C. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, submit certification stating that such requirements have been complied with.
- D. Codes and regulations:
 - 1. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies having jurisdiction.
 - 2. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. Manufacturer's specifications, catalog cuts, and other data needed to prove

- compliance with the specified requirements;
- 3. Shop drawings and other data as required to indicate method of installing and attaching equipment, except where such details are fully shown on the Drawings.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

- 2.1 Unless otherwise specified here, pipe hangers and supports shall be manufactured by Grinnell Co., Inc., Carpenter and Patterson, Inc., or equal. Any references to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary. Any item comparable in type, style, quality, design and performance will be considered for approval.

2.2 HANGERS AND SUPPORTS SCHEDULE: Catalog numbers refer to Grinnell.

- A. Adjustable Pipe Support
 - 1. Adjustable pipe supports shall be equal to Grinnell Fig. No. 264.
 - 2. Supporting pipe shall be schedule forty (40) galv. steel pipe with a flange base.
- B. Wall Supported Pipes (two (2) inch & smaller)
 - 1. Shall be supported by brackets equal to Grinnell Fig. No. 213.
- C. Wall Supported Pipes (larger than two (2) inches)
 - 1. Shall be supported by welded steel brackets equal to Grinnell Fig. No.'s 194, 195 and 199 as required.

2.3 FASTENERS AND INSERTS

- A. Fasteners shall be equal to Hilti Drop-In Anchors, Star, Drop-Grip Anchors or equal.
- B. Inserts shall be equal to P3200 Series by Unistrut.

2.4 FINISHES

- A. All rods, clamps, hangers, inserts, anchor bolts, brackets and components for interior pipe supports shall be furnished with galvanized finish. Interior clamps on plastic pipe shall be plastic coated. Supports for copper pipe shall be copper plated or shall have a 1/16-inch plastic coating. All rods, clamps, hangers, inserts, anchor bolts, brackets, and components for pipe within pH control chamber shall be of Type 316 stainless steel, unless otherwise noted on the Drawings.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. All piping shall be rigidly supported from structures by approved hangers, inserts, or supports with provisions for expansion or contraction.
 - 1. No piping shall be supported from other pipes.
 - 2. Continuous metal inserts shall be embedded flush with the concrete surface.
- B. Pipe supports shall be provided as follows and as shown on the Drawings:
 - 1. Supports for PVC shall be as recommended by the manufacturer except that support spacing shall not exceed three (3) feet.
 - 2. Support spacing for copper tubing shall not exceed five (5) feet.

END OF SECTION

SECTION 15100

VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide all valves and appurtenances as required by the Contract Documents.
- B. The items of this Section shall include but not be necessarily be limited to:
 - 1. Check Valves
 - 2. Butterfly Valve
 - 3. Motor Operated Butterfly Valve
 - 4. Well Service Valve
- C. Related Work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 15060 Interior Piping, Fittings and Appurtenances

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Codes and regulations:
 - 1. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies having jurisdiction.
 - 2. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern.
- C. All of the types of valves and appurtenances shall be products of established firms who are experienced in the manufacture of the particular equipment to be furnished.
- D. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.

- B. Product data: Within 14 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. Manufacturer's specifications, catalog cuts, and other data needed to prove compliance with the specified requirements;
 - 3. Shop Drawings and other data as required to indicate method of installing and attaching equipment, except where such details are fully shown on the Drawings.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. General
 - 1. All valves and appurtenances shall be of the size shown on the Drawings and as far as possible all equipment of the same type shall be from one manufacturer.
 - 2. All valves and appurtenances shall have the name of the manufacturer, flow directional arrows, and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.
 - 3. All valves shall open clockwise. Operators shall have arrows cast thereon to indicate the direction of rotation to operate the valve.
- B. Check valves shall be of the globe style, 1800 series silent check as manufactured by Val-Matic Valve and Manufacturing Corp., Elmhurst, IL, or an equal. The valve shall have the following attributes:
 - 1. Body: cast iron with flanged ends conforming to ANSI Class 125.
 - 2. Seat: Bronze
 - 3. Plug: Bronze
 - 4. Spring: Stainless steel
 - 5. Bushing: Bronze
 - 6. Drop tight seating at 150 psi
- C. Butterfly valves shall meet or exceed the latest requirement of ANSI/AWWA C504 and comply with the following:
 - 1. End flange shall conform in dimension and drilling to ANSI B16.1, Class 125 cast iron flange.
 - 2. Body: Cast iron meeting or exceeding the requirements of ASTM A126, Class B.
 - 3. Shaft: Type 304 stainless steel
 - 4. Disc: Ductile iron meeting the requirements of ASTM A536 with a stainless steel edge
 - 5. Seat: Teflon
 - 6. Direction of operation: open right

- D. Butterfly valves shall meet or exceed the latest requirement of ANSI/AWWA C504 and comply with the following:
1. Shall be series 31 Butterfly Valve manufactured by Bray Controls
 2. End flanges shall conform in dimension and drilling to ANSI B16.1, Class 125 cast iron flange
 3. Body: cast iron meeting or exceeding the requirements of ASTM A126, Class B
 4. Shaft: type 304 stainless steel
 5. Disc: To be stainless steel
 6. Seat: EDPM
 7. Direction of operation: open clockwise
 8. Operator:
 - a. Electric actuator shall be series 70-121 as manufactured by Bray Controls
 - i. Nominal rotation: 90 degrees
 - ii. 110 VAC
 - iii. Manual override with operating handle
 - iv. Visual indication: raised dome
 - v. Limit/Auxiliary switches: 2 x 16 A SPDT for report back signal
 - vi. Duty rating: 30%
 - vii. Thermal protection: motor thermostat
 - viii. NEMA 4X Enclosure
 - ix. Temperature: -4 to 158 degrees F
 - x. Finish: Zinc plate, two part polyurethane
 - xi. Life: 100,000 operations minimum
 - xii. Heater: 25 W, standard
 - b. All electric actuators shall be fitted with butterfly valves and tested by valve actuator supplier prior to shipment to site.
- E. Well service air valve; shall be model 103WS as manufactured by Val-Matic Valve and Mfg., Corporation, Elm Hurst Il.
1. 300 psi working pressure
 2. All stainless steel trim
 3. One (1) inch threaded inlet and outlet
 4. Cast iron body
 5. Stainless steel float and baffle screen
 6. Ductile iron baffle

2.2 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 VALVE INSTALLATION

- A. The valves and appurtenances shall be installed at the locations shown on the Drawings. Valve operators shall be easily accessible and rigidly supported.
 - 1. After installation check valve operation. Valve shall operate smoothly through its entire operating range.
 - 2. Coordinate the work of this Section with the work of other Sections.

END OF SECTION

SECTION 15190

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide pipe markers and valve tags on all exterior piping and valves, as required by the Contract Documents.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications .

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. The Specifications are based on identification products manufactured by Seton Name Plate Co., Branford, CT. Identification products of equal quality may be considered.
- C. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 20 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications, catalog cuts, and other data needed to prove compliance with the specified requirements.
 - 3. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 VALVE TAGS

- A. Valve tags: Shall be Seton Standard Brass Valve Tags as manufactured by Seton, Branford, CT., or an approved equal.
 - 1. Two (2) inch, octagon shaped
 - 2. Stamped characters
 - a. 1/4-inch high letter abbreviations
 - b. 1/2-inch high numbers
 - c. All characters shall be black filled
 - 3. Material: Approximately 19 gauge brass
 - 4. Top hole: 3/16-inch
- B. Valve tag fasteners: Shall be Seton No. 16 brass jack chain or an approved equal.
 - 1. Adjustable open and close links
 - 2. Solid brass
 - 3. Approximately 25 links per foot

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until satisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install the work of this Section in strict accordance with the manufacturer's recommendations as approved by the Engineer, using only the approved mounting materials.
- B. Install a valve tag on all butterfly valves. Letter abbreviations and numbers shall be per submitted and approved valve schedule.
 - 1. Affix valve tag so that it does not interfere with the operation of the valve.
 - 2. Do not affix valve tag to valve handle.

END OF SECTION

SECTION 15400

PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide plumbing as required by the Contract Documents including, but not necessarily limited to:
 - 1. Domestic cold water piping systems;
 - 2. Drain, waste, and vent systems;
 - 3. Air condition piping;
 - 4. Sample tap and gauges;
 - 5. Water flush line to valve vault.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Section 02221 Trenching, Backfilling and Compacting
 - 3. Section 15830 Unit Heaters

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Codes and regulations:
 - 1. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies having jurisdiction.
 - 2. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern.
 - 3. Give notices, file plans, obtain permits and licenses, pay fees and back-charges, and obtain necessary approvals from authorities having jurisdiction, and as required by the Contract Documents.
- C. Drawings

2. All piping shall be installed as closely as possible to walls, ceilings and other structural parts (consistent with proper spacing for covering, removal of pipe, and access to accessories, such as, valves, strainers, etc.) so as to occupy the minimum space, and all offsets and fittings required to accomplish this shall be furnished without additional expense to the Owner.
- D. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 1. Materials list of items proposed to be provided under this Section;
 2. Manufacturer's specifications, catalog cuts, and other data needed to prove compliance with the specified requirements;
 3. Shop Drawings and other data as required to indicate method of installing and attaching equipment, except where such details are fully shown on the Drawings.
- C. Comply with Section 01730 when work is complete and submit Operation and Maintenance Manuals.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 PIPE

- A. Drain, waste, and vent system (where shown on the Drawings):
 1. For sanitary work below the floor and outside underground:
 - a. Shall be extra heavy bell and spigot cast iron soil pipe and fittings conforming to ASTM A-74 and ANSI A112.5.1.
 - b. All pipe and fittings shall be of domestic manufacture.
 - c. Joints shall be made of the compression gasket type.
 2. Above Ground
 - a. Sizes four (4) inches and larger. Provide hubless cast iron with "No Hub" system fittings.
 - b. Sizes three (3) inches and smaller: Provide copper tube DWV in compliance with ASTM-B306 and ANSI 23.6, where shown on the Drawings, otherwise provide cast iron, "No Hub" system.

- c. Joints shall be made of the compression gasket type.
- 2. Above Ground
 - a. Sizes four (4) inches and larger. Provide hubless cast iron with "No Hub" system fittings.
 - b. Sizes three (3) inches and smaller: Provide copper tube DWV in compliance with ASTM-B306 and ANSI 23.6, where shown on the Drawings, otherwise provide cast iron, "No Hub" system.
- B. Interior Water Piping
 - 1. Cold water, piping shall be type L copper tubing, which meets or exceeds the requirements of ASTM B88.
 - 2. Joints shall be of the sweat type.
 - 3. Reducing type fittings shall be used in lieu of bushings.
 - 4. Joint shall be made up with 95-5 solder, consisting of 95 percent tin and 5 percent antimony.
 - 5. Flanged connections shall be made with brass or bronze sweated flanges or brass or bronze fittings with integral flanges.
 - 6. All pipe and fittings shall be of domestic manufacture.
 - 7. Piping adjacent to plumbing fixtures where exposed shall be iron size (85 percent copper pipe with cast pattern brass screw fittings) and shall be chrome plated.
- C. Below Ground:
 - 1. Polyethylene 200 psi .
- D. Unions:
 - 1. For copper lines, provide copper fittings.
 - 2. For connections on iron pipe lines 2-1/2" and smaller, provide ground joint brass-to-iron fittings.
 - 3. Dissimilar material use a dielectric union.

2.2 VALVES

- A. General
 - 1. Valves in general shall be of the same manufacturer throughout, unless noted otherwise. Valves shall be equal to those manufactured by Nibco or Crane.
 - 2. Control valves shall be installed at the bottom of all potable water service risers and as noted on the drawings.
 - 3. Control valves shall be grouped and located so they may easily be operated adjacent to equipment.
- B. Ball Valves: Provide two (2) piece bronze body 4000# WOG, teflon seats and seals with adjustable packing gland.
 - 1. Two (2) inch and smaller: Provide Nibco 580 Series or an approved equal.

- C. Gate Valves: Provide solid wedge disc, rising stem, 200# WOG; non-rising stem valves may be used only where there is insufficient clearance.
 - 1. Three (3) inches and smaller, rising stem: Provide Nibco Figure T111 or an approved equal.
- D. Globe Valves: Provide replaceable composition disc suitable for 200 degree F water.
 - 1. Three (3) inch and smaller: Provide Nibco Figure 211 or an approved equal.
- E. Check Valves:
 - 1. Three (3) inches and smaller: Provide Nibco Figure 433 or an approved equal.
- F. Electric Valve: Provide electric solenoid controlled valve for sludge rinse line to piping vault.
 - 1. Valve to be 110 volts AC, 1" diameter, 2-way valve, brass valve, equal to ASCO Redhat Series 210.

2.3 CLEANOUTS

- A. Shall be Zurn-1400 "Level Trol" with satin finish bronze top.

2.4 SLEEVES

- A. All sleeves shall be galvanized Schedule 40 steel pipe.
 - 1. All piping through walls, beams and floor shall be sleeved.
 - 2. Sleeves shall finish flush with the finish surface on walls and beams.
 - 3. Floor sleeves shall extend two (2) inches above the finished floor surface.
 - 4. All sleeves shall be sealed.

2.5 ESCUTCHEONS

- A. Shall be heavy cast brass, chromium plated, adjustable and of sufficient outside diameter to cover the sleeve opening and fit snugly around the pipe.

2.6 GAUGES

- A. Dial size shall be 2 1/2-inches in diameter with a stainless steel tube and socket.
 - 1. Case shall be stainless steel and weatherproof.
 - 2. Movement shall be stainless steel.
 - 3. NPT shall be 1/4-inch on the bottom.
 - 4. Ring shall be of the bayonet type made of stainless steel.
 - 5. Shall have an adjustable pointer.
 - 6. Gauge shall be an Ashcroft Industrial Gauge, Type 1009 as manufactured by Ashcroft or an equal by U.S. Gauge or Marsh.
- B. Gauge Accessories:
 - 1. All connecting piping and fitting shall be brass.
 - 2. Pressure snubber: brass.

3. Gauge cock shall be brass.

2.7 HANGERS, SUPPORTS AND ANCHORS

- A. Commercial quality products as manufactured by Carpenter and Patterson or ITT Grinnell, as required for each particular application.
 1. All hangers and supports shall be hot dip galvanized or stainless steel except for items specified to be copper or plastic coated.
- B. Anchors
 1. All anchoring devices shall be hot-dip galvanized or stainless steel.
 2. No powder actuated anchors shall be allowed.

PART 3 - EXECUTION

All the items specified under this Section shall be installed according to the applicable manufacturer's recommendations, the details shown on the Drawings and as specified herein.

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PLUMBING SYSTEM LAYOUT

- A. Lay out the plumbing system in careful coordination with the Drawings, determining proper elevations for all components of the system and using only the minimum number of bends to produce a satisfactorily functioning system.
- B. Follow the general layout shown on the Drawings in all cases except where work may interfere.
- C. Lay out pipes to fall within partition, wall, or roof cavities, and to not require furring other than as shown on the Drawings.

3.3 TRENCHING AND BACKFILLING

- A. Perform trenching and backfilling associated with the work of this Section in strict accordance with the provisions of Section 02220 of these Specifications.
- B. Cut bottom of trenches to grade. Make trenches 12-inches wider than the greatest dimension of the pipe.
- C. Bedding and backfilling:
 1. Install piping promptly after trenching. Keep trenches open as short a time as practicable.

2. Under the building, install pipes on a 6-inch bed of damp sand. Backfill to bottom of slab with damp sand.
3. Outside the building, install underground piping on a 6-inch bed of damp sand.
4. Backfill to within 12" of finish grade with damp sand. Backfill remainder with native soil.
5. Do not backfill until installation has been approved and until Project Record Documents have been properly annotated.

3.4 INSTALLATION OF PIPING AND EQUIPMENT, GENERAL

A. General:

1. Proceed as rapidly as the building construction will permit.
2. Thoroughly clean items before installation. Cap pipe openings to exclude dirt until fixtures are installed and final connections have been made.
3. Cut pipe accurately, and work into place without springing or forcing, properly clearing windows, doors, and other openings. Excessive cutting or other weakening of the building will not be permitted.
4. Show no tool marks or threads on exposed plated, polished, or enameled connections from fixtures. Tape all finished surfaces to prevent damage during construction.
5. Make changes in directions with fittings; make changes in main sizes with eccentric reducing fittings. Unless otherwise noted, install water supply and return piping with straight side of eccentric fittings at top of the pipe.
6. Run horizontal sanitary and storm drainage piping at a uniform grade of 1/4-inch per foot, unless otherwise noted. Run horizontal water piping with an adequate pitch upwards in direction of flow to allow complete drainage.
7. Provide sufficient swing joint, ball joints, expansion loops, and devices necessary for a flexible piping system, whether or not shown on the Drawings.
8. Support piping independently at pumps, coils, tanks, and similar locations, so that weight of pipe will not be supported by the equipment.
9. Pipe the drains from pump glands, drip pans, relief valves, air vents, and similar locations, to spill over an open sight drain, floor drain, or other acceptable discharge point, and terminate with a plain end unthreaded pipe 6-inches above the drain.
10. Securely bolt all equipment, isolators, hangers, and similar items in place.
11. Support each item independently from other pipes. Do not use wire for hanging or strapping pipes.
12. Provide complete dielectric isolation between ferrous and non-ferrous metals.
13. Provide union and shut off valves suitably located to facilitate maintenance and removal of equipment and apparatus.

B. Equipment Access :

1. Install piping, equipment, and accessories to permit access for maintenance. Relocate items as necessary to provide such access, and without additional cost to the Owner.

3.5 PIPE JOINTS

- A. Copper tubing:
 - 1. Cut square, remove burrs, and clean inside of female fitting to a bright finish.
 - a. Apply solder flux with brush to tubing.
 - b. Remove internal parts of solder-end valves prior to soldering.
 - 2. Provide dielectric unions at points of connection of copper tubing to ferrous piping and equipment.
 - 3. For joining copper tubing use:
 - a. Water piping 3-inch and smaller: 95-05 solder;
 - b. Underground: Silver Solder.
- B. Screwed piping:
 - 1. Deburr cuts.
 - a. Do not ream exceeding internal diameter of the pipe.
 - b. Thread to requirements of ANSI B2.1.
 - 2. Use teflon tape on male thread prior to joining other services.
- C. Leaky joints:
 - 1. Remake with new material.
 - 2. Remove leaking section and/or fitting as directed.
 - 3. Do not use thread cement or sealant to tighten joint.

3.6 HANGERS, ANCHORS AND INSERTS

- A. Provide adjustable clevis hangers. Hanger rods shall have machine threads.
- B. Hangers shall support piping from building structure to maintain required grade and pitch of pipe lines, prevent vibration, secure piping in place, and provide for expansion and contraction. Hangers shall be secured to inserts whenever practical.
- C. Vertical brackets shall be used where horizontal piping is racked along walls. Trapeze hangers may be used where conditions permit. Hangers for insulated piping shall be outside insulation with 12-inch long galvanized insulation shields.
- D. Hanger rods shall be connected to beam clamp, UL approved concrete inserts, or Phillips, or approved equal, expansion shields as required to attach to building construction. No ram-set or shot shields will be allowed.
 - 1. Provide sway bracing on hangers longer than 18-inches.
- E. Hanger spacing shall conform to requirements of state and local plumbing codes. In no case shall horizontal piping be supported at intervals greater than 8 ft.-0 in.
- F. Provide insulation continuous through hangers and rollers. Protect insulation by galvanized steel shields.

- G. Arrange pipe supports to prevent excessive deflection, and to avoid excessive bending stress.
- H. Support piping from inserts or anchors in concrete slabs. Provide the inserts under this Section and arrange for the placing under Section 03300 of these Specifications.
- I. Hubless piping:
 - 1. Provide hangers on the piping at each side of, and within 6-inches of hubless pipe coupling so the coupling will bear no weight.
 - 2. Do not provide hangers on couplings.
 - 3. Provide hangers adequate to maintain alignment and to prevent sagging of the pipe.
 - 4. Make adequate provision to prevent shearing and twisting of the pipe and the joint.

3.7 SLEEVES AND OPENINGS

- A. Provide sleeves for each pipe passing through walls, partitions, floors, roofs, and ceilings.
 - 1. Set pipe sleeves in place before concrete is placed.
 - 2. For uninsulated pipe, provide sleeves two pipe sizes larger than the pipe passing through, or provide a minimum of 1/2-inch clearance between inside and outside of the pipe.
 - 3. For insulated pipe, provide sleeves of adequate size to accommodate the full thickness of pipe covering, with clearance for packing and caulking.
- B. Caulk the space between sleeve and pipe or pipe covering, using a noncombustible, permanently plastic, waterproof, non-staining compound which leaves a smooth finished appearance, or pack with noncombustible asbestos cotton, rope, or fiberglass to within 1/2-inch of both wall faces, and provide the waterproof compound described above.
- C. Finish and escutcheons:
 - 1. Smooth up rough edges around sleeves with plaster or spackling compound.
 - 2. Provide 1-inch wide chrome or nickel plated escutcheons on all pipes exposed to view where passing through walls, floors, partitions, ceilings, and similar locations.
 - a. Size the escutcheons to fit pipe and a covering.
 - b. Hold escutcheons in place with set screw.

3.8 CLEANOUTS

- A. Secure the Engineer's approval of locations for cleanouts in finished areas prior to installation.
- B. Provide cleanouts of same nominal size as the pipes they serve; except where cleanouts are required in pipes 4-inch and larger provide 4-inch cleanouts.
- C. Make cleanouts accessible. After pressure tests are made and approved, thoroughly graphite the cleanout threads.

3.9 VALVES

- A. Provide valves in water, air, and gas systems. Locate and arrange so as to give complete regulation of apparatus, equipment and fixtures.
- B. Provide valves in at least the following locations:
 - 1. In branches and/or headers of water piping serving a group of fixtures.
 - 2. On both sides of apparatus and equipment.
 - 3. For shutoff of risers and branch mains.
 - 4. For flushing and sterilizing the system.
 - 5. Where shown on the Drawings.
- C. Locate valves for easy accessibility and maintenance.
 - 1. Control valves to all equipment and fixtures shall be installed, grouped and located so they will be easily operated, through access panels, doors, or adjacent to equipment.
 - 2. Valves shall be installed in horizontal to upright position and shall not be installed in down position from the horizontal.

3.10 OTHER TESTING AND ADJUSTING

- A. Provide personnel and equipment, and arrange for and pay the costs of, all required tests and inspections required by governmental agencies having jurisdiction.
- B. Where tests show materials or workmanship to be deficient, replace or repair as necessary, and repeat the tests until the specified standards are achieved.
- C. Adjust the system to optimum standards of operation.

3.11 CLEANING

- A. At the completion of the Work of this Section:
 - 1. Clean all fixtures, equipment, apparatus and exposed trim.
 - 2. Protect this work during construction. All finished work which is damaged shall be replaced.
 - 3. Flush all drainage systems to insure the lines are free of all debris.

END OF SECTION

SECTION 15500

HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide ventilating equipment as shown on the Drawings, specified herein and as needed for a complete and proper installation including, but not necessarily limited to:
 - 1. Fan
 - 2. Shutter
 - 3. Louver
 - 4. Split Ductless Air Conditioning system
 - 5. Insulation for AC lines
 - 6. Condensate Drain Lines
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Section in Division 1 of these Specifications.
 - 2. Division 16 – Electrical
 - 3. Plumbing

1.2 INTERPRETATION OF DRAWINGS

- A. All work shown on the Drawings is intended to be approximately correct to scale, but figured dimensions and detailed drawings are to be followed in every case. The Drawings shall be taken in a sense as diagrammatic. Size of pipes and methods of running them are shown but it is not intended to show every offset and fitting, nor every structural difficulty that may be encountered. To carry out the true intent and purpose of the Drawings all necessary parts to make complete approved working systems ready for use shall be furnished without extra charge. All work shall be installed in such a manner to avoid being unsightly.
- B. Locations shown on the Drawings are approximate and it is intended that all equipment shall be located in accordance with the general and detail Drawings of the construction proper. All measurements shall be taken at the site.

1.3 ORDINANCES, PERMITS AND CODES

- A. All the work of this Section shall be installed in accordance with the laws, ordinances and rules and regulations of the local and state authorities which have jurisdiction and in compliance with the rules and regulations of the pertinent public utilities serving the structure.

- B. Obtain all the required permits and pay all associated fees for the work of this Section.

1.4 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.5 EQUIPMENT SUPPORT

- A. Steel channels, flat iron and channel iron shall be furnished and installed for the support of all HVAC equipment and devices, where required, including all anchors, insert bolts, nuts and washers, etc. for a rigid installation.

1.6 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Drawings showing proposed layout of equipment, ducts, registers, grills, controls, and other components of the system;
 - 2. Manufacturer catalogs, samples, and other items needed to fully demonstrate the quality of the proposed materials and equipment.
- C. Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer two copies of an operation and maintenance manual compiled in accordance with the provisions of Section 01730 of these Specifications.
- D. The Drawings are a diagram and are not intended to show all fittings, pipes, offset or exact location of equipment. Contractor shall provide all equipment and materials necessary to complete the system as designed.

1.7 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 FAN

- A. Exterior roof mount fan shall be manufactured by Loren Cook Model 1215AG.

1. Fan shall be direct driven, cast aluminum propeller exhaust with a spun aluminum top cap.
2. Fan shall be manufactured at an ISO 9001 certified facility and shall be listed by Underwriters Laboratories (U.L. 705).
3. Roof fan shall have a capacity of 500 cfm at .5 inches of static pressure.
4. Fan shall be bolted and welded construction utilizing corrosion resistant fastener.
 - a. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure.
 - b. The aluminum base shall have continuously welded curb cap corners for maximum leak protection.
 - c. The motor, bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators.
 - d. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA Certified Transit Tested Packaging.
5. The propeller shall be cast aluminum airfoil design with a cast aluminum hub.
 - a. The blade pitch shall be factory set and locked using two set screws or a taper lock bushing.
 - b. Propeller shall be balanced in accordance with AMCA Standard 204-96 Balance Quality and Vibration Levels for Fans.
6. The motor shall be heavy-duty rating with a motor size recommended by manufacturer to exceed design condition. Motor to have permanently lubricated sealed ball bearings. Motor to be rated for 230 volts AC two (2) speed and single phase.
7. The bearings shall be designed and individually tested specifically for use in air handling applications.
 - a. Construction shall be heavy-duty regreasable ball type in cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

2.2 FAN SHUTTER

- A. Furnish and install one (1) intake shutter one in roof.
 1. Provide all aluminum constructed shutter
 2. Shutter to be gravity close type
 3. Shutter to be designed for a 20" x 20" opening or as constructed by Contractor.

2.3 LOUVERS/DAMPERS

- A. Provide one (1) motor operated intake louver, as sized on the Drawings. Furnish and install where indicated on the Drawings shall be CS 6-inch (152.4 mm) Double Drainable Dual Combination Mullion Louver, Model No. 6967 as manufactured by Construction Specialties Inc.
 1. Heads, sills, jambs and mullions shall be one-piece structural members of 6063-T62 alloy with integral caulking slots and retaining beads. Mullions shall be sliding interlock type.

2. Extrusion thicknesses shall be as follows:
 - a. Heads, sills, jambs and mullions: 0.81" (2.06 mm)
 - b. Fixed blades: 0.81" (2.06 mm)
 - c. Operating blades: 0.81" (2.06 mm)
 - d. All fasteners to be aluminum or steel.
 3. All louvers to be furnished with 5/8-inch (15.87 mm) flattened expanded mesh, aluminum bird screen with a .055" (1.4 mm) thick extruded aluminum frame.
 - a. Screen and screen frames to be standard mill finish.
 4. Operating blades shall have 1/2-inch diameter, zamac alloy pinions operating in self-lubricating nylon bearings. All operating blades shall be operated by concealed drive arms at each jamb and mullion, and assembled with stainless steel shoulder rivets. Drive arms to be interconnected by a 5/8-inch (15.88 mm) diameter torque bar.
 5. All louver blades and sills shall be equipped with vinyl gaskets.
 6. All louvers shall be finished with C/S Kynar 500®/Hylar 5000®, a minimum 1 mil. (.025 mm) thick full strength 70% resin Fluoropolymer coating.
 - a. All finishing procedures shall be one continuous operation in the plant of the manufacturer.
- B. Louver Colors
1. Shall be selected by the Engineer from the manufacturer's standard colors.
- C. Electric Operators: Shall be Belimo actuators as supplied by Construction Specialists Inc. or equal.
1. Shall be two position with manual override.
 2. Intake: Fail-safe actuator: power open, spring return, fail-safe closed
 3. 110V power, 60 Hertz, single phase.
 4. Shall have an auxiliary limit switch (SPDT).
 5. Unit shall be pre-wired, mounted to the louver and tested before shipment.
 6. Provide an operator for each louver
 7. Provide the following adjustable time settings in seconds: 1.Open 2. Close 3. Fail-safe

2.4 CONTROLS

- A. HVAC UNIT
1. Provide single stage, low voltage (24V) thermostat with a range of 55 to 95 °F.
 2. Provide wiring and programming to control proposed HVAC (AC) unit.
 3. Set points as directed by owner.

2.5 VIBRATION ISOLATORS

- A. Provide appropriate isolation bases, pads and vibration hangers for equipment. Vibration eliminators shall be selected for uniform static deflection according to distribution of weight, and shall be of sufficient strength to ensure that springs will not compress totally under weight of equipment. Wherever rotational speed is disturbing frequency, lowest rotational speed in system shall be used in sizing isolators, hangers, etc.

- B. Selection of correct isolators for use application shall be made by manufacturer subject to Engineer's approval.

2.6 INSULATION

- A. Pipe insulation: Applied to AC refrigerant lines shall be a nominal 1-inch thickness for both AC and heating applications; Johns Manville Micro-Lok HP High Performance Fiberglas Insulation with ASJ SSL (All Service Jacket with Self-sealing lap), or approved equal.
 - 1. Shall have pressure-sealing lap adhesive, no metal bands or staples allowed.
- B. Fittings Flanges and Valves: Shall be covered with permanently noncombustible one-piece factory pre-molded insulated PVC fitting covers (Zeston PVC). Fiberglass insulation shall be applied to the fittings. The end of the insulation shall be tucked snugly into the throat of the fitting and the edge adjacent to the pipe covering tucked in, fully insulating the pipefitting. The one-piece PVC fitting cover shall be secured with stainless steel tack fastening. All seam edges of the cover shall be sealed with pressure sensitive vapor barrier tape, color to match. The tape shall extend over the adjacent insulation and overlap 2-inches beyond fitting cover.
 - 1. Insulation thickness on all fittings, flanges and valves shall be same thickness as listed for pipe and tubing.
- C. Provide weather protective jacket for outdoor applications and Zeston PVC jacketing on indoor applications.

2.7 SPLITDUCTLESS HVAC SYSTEM

- A. For the purposes of specifying the type and quality of product, the split-ductless air conditioning system described under this specification is based upon CityMulti Model PKFY-P30NKMU indoor unit paired with Model PUMY-P48 NHM4 outdoor unit, as manufactured by Mitsubishi Electric, HVAC Advanced Products Division, Suwanee, GA. Products of equal material quality and performance that meet the requirements of this specification may be considered.
- B. All materials shall be of the kind and quality specified, and where the quality is not specified, it shall be the best of the respective kinds and suitable for the purpose intended.
- C. General Features: Split ductless system components shall be fully compatible and factory matched for rated cooling load. Shall be listed by ETL, U.L., or equal, AHRI certified and bear the Energy Star rating. General features shall include, but may not be limited to:
 - 1. Side-discharge outdoor unit.
 - 2. Hard-wired wall-mounted controller.
 - 3. Automatic fan speed control.
 - 4. Advanced microprocessor control.

5. Quiet operation – both indoor and outdoor units.
 6. Cooling capacity
 7. Heating capacity
- D. Construction/Performance: Split-ductless air conditioning system shall meet the following construction/performance criteria including, but may not be limited to:
1. Operating Temperature range. Cooling (outdoor) 23 °F – 115 °F DB.
 2. SEER 15.5/16.7.
 3. Indoor Unit Cooling: 30,000Btu/h.
 4. Indoor Unit air flow: 710 – 920 (Lo-Hi) CFM.
 5. Indoor Heating: 34,000 Btu/h.
 6. Indoor Unit Compressor: DC inverter-driven Hermetic.
 7. Compressor/Fan Protection Device.
 8. High Pressure Protection Device.
 9. Outdoor Unit sound level: 58/59 dB (A).
 10. Refrigerant type: R410A.
 11. Outdoor unit nominal cooling capacity; 48,000 Btu/h.
 12. Outdoor unit nominal heating capacity; 54,000 Btu/h.

2.8 FAN CURB

- A. Fan curb to be furnished by fan manufacture and compatible with fan mounting.
1. Curb shall be designed for flat roof mounting with a rubber roofing.
 2. Curb to consist of a treated wood nailer insulating core and aluminum encasement

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION

- A. Installation shall be in strict accordance with the best practice of the involved trades and with the respective manufacturer's instructions and recommendations.

- B. Follow manufacturer's installation instructions.
- C. Ceiling fan to be installed on existing curb.
- D. Electrical Connection
 - 1. Electrical connections shall be made under Division 16. This work shall involve, but not be limited to:
 - a. Installing and wiring thermostats.
 - b. Providing wire and power for all fans.
 - c. Provide wire and power for split ductless AC unit.

3.4 INSTRUCTIONS

- A. Upon completion of this portion of the Work, and prior to its acceptance by the Owner, provide a qualified engineer and fully instruct the Owner's maintenance personnel in the proper operation and maintenance of items provided under this Section.

3.5 TESTING AND ADJUSTING

- A. Test and adjust each piece of equipment and each system as required to assure proper balance and operation.

END OF SECTION

INDEX

DIVISION 16 - ELECTRICAL - (FILED SUB-BID REQUIRED)

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SECTION 16000

ELECTRICAL – GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SUB-BID REQUIREMENTS

- A. In accordance with "Massachusetts General Laws, Chapter 149, Section 44A through 44L inclusive as amended", the Engineer declares that all of the work of this Division shall be estimated under the appropriate Item of Part II of the Form for General Bid, and that each sub-bidder on this work shall submit his bid and bid security as detailed in the Advertisement.
 - 1. Details for the procedure for filing sub-bids are contained in the Instructions to Bidders.
 - 2. The Work of this Division is shown on Drawings E1-E8, summarized in Section 01010, 02070 and Division 16 Specifications.

1.2 DESCRIPTION

- A. Work included: The work to be done under this Division includes but is not limited to all wiring and equipment for the new Springvale No. 4 Pump Station and the controls for the Backwash Tank System.
- B. Related Work:
 - 1. Documents affecting work of this Division include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.
- C. Connections
 - 1. The electrical sub-contractor shall provide the necessary devices to make connections to equipment furnished by other Sections and not necessarily limited to the above mentioned Sections.
 - 2. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Division shall be furnished at no extra cost.
- D. Scope of Work
 - 1. See Section 01010 for new work and Section 02070 for demolition work.

1.3 QUALITY ASSURANCE

- A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Division.

- B. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this Section.

1.4 CODES, INSPECTION AND FEES

- A. All material and installation shall be in accordance with the latest edition of the National Electrical Code and the codes and ordinances of the Town of Natick.
- B. Pay all fees required for permits and inspections.
- C. All equipment, materials and systems shall be provided, designed, manufactured, finished, painted, tested, inspected, packaged, shipped, stored, installed, and connected, in accordance with the most stringent requirements of the National Electrical Code (NEC), the General Industry Standards of OSHA, and all local, county, state and federal laws; and in accordance with the published codes, standards and specifications of the following organizations:
 - 1. ANSE American National Standards Institute
 - 2. ASTM American Society for Testing and Materials
 - 3. ICEA Insulated Cable Engineers Association
 - 4. IEEE Institute of Electrical and Electronics Engineers
 - 5. ISA Instrument Society of America
 - 6. NEC National Electrical Code
 - 7. NEMA National Electrical Manufacturers Association
 - 8. NFPA National Fire Protection Association
 - 9. OSHA Occupational Safety and Health Administration of the U.S. Department of Labor
 - 10. UL Underwriters Laboratories, Inc.

1.5 TESTS

- A. Test all systems furnished under Division 16. Repair or replace all defective work; make all necessary adjustments to the systems and instruct the Owners personnel in the proper operation of the systems.
- B. Make all circuit breaker and motor circuit protector settings.
- C. The following minimum tests and checks shall be made prior to the energizing of the electrical equipment. A certified test report shall be submitted stating that the equipment and systems are in accordance with these Specifications and the manufacturers' job specifications, and that the equipment, systems and installations conform to all applicable codes, standards and specifications.
 - 1. Testing of circuit breakers and motor circuit protectors for calibration and proper operations.
 - 2. Over potential, high potential, insulation resistance, and conductor and shield continuity tests for wires and cables.
 - 3. Mechanical inspection of switches, motor circuit protectors and circuit breakers to assure proper operation.

4. Check all wire and cable terminations for tightness and torque values where specified.
5. Field set all transformer taps as required to obtain the proper secondary voltage.
6. Check motor nameplates for correct phase and voltage.
7. Check the ampere rating of all thermal overload elements for motors and submit a typed record to the Engineer of same, as well as location and designation, listing the nameplate service factor, horsepower and full load current. If inconsistencies are found, new thermal elements shall be supplied and installed by this Contractor.
8. Obtain permission from the General Contractor to start motors, and proceed to check for proper rotation. Correct incorrect rotation. Take all necessary precautions not to damage any equipment.
9. Carefully check interlocking, control and instrument wiring for each system, and/or part of a system to assure that the system will function properly as indicated by schematic and wiring diagrams.
10. Provide all instruments and equipment required for the above tests.
11. A certified test report shall then be submitted stating that the equipment and systems are in accordance with these Specifications and the manufacturers job specifications, and that the equipment, systems and installations conform to all applicable codes, standards and specifications.

1.6 SLEEVES

- A. Core drilling shall be required for installation of all conduits penetrating floors and walls.
- B. Mechanical type seals equal to "Link Seal" shall be used to seal void between conduit and cored openings.

1.7 INTERPRETATION OF DRAWINGS

- A. The electrical Drawings are diagrammatic and do not show the exact location of devices and conduit runs.
 1. The mounting heights of lighting fixtures, switches and receptacles shall be checked and verified by the Engineer, along with the exact location.
 2. Each three phase circuit shall be run in a separate conduit unless otherwise shown on the Drawings.
 3. Any work installed contrary to or without approval by the Engineer shall be subject to change as directed by the Engineer, and no extra compensation will be allowed for making these changes.
 4. The locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.
 5. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.

6. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of the equipment.
 7. All connections to equipment shall be made as required, and in accordance with the approved shop and setting drawings.
 8. Instrumentation, cables and wires shall be run in a separate conduit.
 9. The wiring system shall be of approved materials. These materials will include conduit, nipples, raceways, wireway, busway, cables, boxes, conductors and gutters as required. Wiring methods to be in accordance with the latest edition of the NEC. All wiring within cabinet shall be in non-metallic conduit - no wires shall be unenclosed.
 10. This project requires a comprehension of the system so that procurement and installation and all wiring of equipment, power, instruments etc., be complete.
 11. Furnish and install all component interconnections.
- B. Investigate each space in the structure through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the structure.
- C. The equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the manufacturer shall be required to brace the equipment suitably to insure that the tilting does not impair the functional integrity of the equipment.

1.8 MATERIALS

- A. Provide only materials that are new, of the type and quality specified. Where Underwriters' Laboratories, Inc. has established standards for such materials, provide only materials bearing the UL label.
- B. Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored outdoors. Electrical equipment shall be stored in dry permanent shelters. If any apparatus has been damaged, such damage shall be repaired at no additional cost. If any apparatus has been subject to possibly injury by water, it shall be thoroughly dried out and put through such special tests as directed by the Engineer, or shall be replaced at no additional cost to the Owner.
- C. Damage to factory applied paint finish shall be repaired using touch-up paint furnished by the equipment manufacturer. The entire damaged panel or section shall be repainted per the field painting specifications at no additional cost to the Owner.

1.9 EXECUTION

- A. Cooperation with other Trades

1. The Electrical Sub-Contractor, before beginning his work, shall confer with the General Contractor and Sub-Contractors for the other trades, relative to the location of pipes, ducts or any fixtures or apparatus to be installed, and is to select his locations so as not to conflict with the work and rights of other Sub-Contractors. In case of conflict between the work of this Sub-Contractor and the work of other trades, this Sub-Contractor shall before proceeding with his work, notify the Engineer immediately and request a decision so that there shall be no delay in the installation of the work. Any work done or materials placed in position in violation of this clause shall be readjusted at the expense of the Electrical Sub-Contractor.

1.10 ELECTRIC UTILITY

- A. The pump station receives power from another building within the site.

1.11 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 1. Materials list of items proposed to be provided under this Division.
 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 3. Shop drawings for the motor control center, variable speed AC drive and all electrical equipment shown on drawings and detailed in specifications.
 4. Dimensional plan, sections and elevations showing means for mounting, conduit connections and grounding and showing layout of components.
 5. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
- C. Manual: Upon completion of this portion of the Work, and as a condition of its acceptance, deliver five copies of the operation and maintenance manuals compiled in accordance with the provisions of Section 01730 of these Specifications. Include within each manual:
 1. Copy of the approved Record Documents for this portion of the Work;
 2. Copies of all circuit directories;
 3. Copies of all warranties and guaranties directories;

1.12 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

1.13 EQUIPMENT IDENTIFICATION

- A. All electrical items shall be identified as outlined below, and as specified in the Sections of this Division of the Specifications. Such identification shall be in addition to the manufacturer's nameplates and shall serve to identify the items function.

1. All equipment shall be identified by means of laminated phenolic labels incised to show 1-inch high, white letters on a black background. Labels shall be fastened by means of 3/16 inch diameter, round head, stainless steel, self tapping screws. Equipment whose designation has been changed shall be labeled accordingly.
2. Wires and cables shall be color coded and identified by means of fiber tags, as specified.
3. Pull and junction boxes shall be identified by stenciling the names of the feeders or system wires and cables passing through them.

1.14 RECORD DRAWINGS

- A. As the work progresses, legibly record all field changes on a set of project Drawings. These drawings shall be given to the Engineer at the completion of the project.

END OF SECTION

SECTION 16110

RACEWAYS AND FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide the complete raceway system as shown on the Drawings and as specified herein.
- B. Refer to Section 16000: General requirements for electrical work.
- C. Furnish all labor, materials, services, equipment and appliances required in connection with providing complete conduit system for conductors.

1.2 APPLICATIONS

- A. Except as otherwise noted on the Drawings, or hereinafter specified, the following shall apply:
 - 1. Non-metallic Schedule 80 conduit shall be used for all underground installations.
 - 2. Non-metallic Schedule 40 conduit shall be used for all building interior installations.
 - 3. All conduit of a given type shall be the product of one manufacturer.
 - 4. Unless noted otherwise on the Drawings or specified herein, all boxes shall be non-metallic.
 - 5. Exposed switch, outlet and control station boxes and fittings shall be non-metallic.
 - 6. Concealed switch, outlet and control station boxes shall be pressed steel.
 - 7. Terminal boxes, junction boxes, pull boxes, etc. used in areas designed as UL (NEMA) type 4 shall be non-metallic.
 - 8. Conduit wall seals shall be used where conduits penetrate walls, floors and other locations as noted on the Drawings.
 - 9. Conduit sealing bushings shall be used at the end of conduits at service pole risers. Provide weatherhead if required by power company.
 - 10. Liquidtight conduits and fittings shall be used to connect to all motors.

1.3 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

1.5 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. A complete parts list for all equipment furnished under this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Non-Metallic Conduit (Interior)
 - 1. Shall be heavy wall, high impact strength rigid PVC conforming to the requirements of:
 - a. EPC-40 PVC conduit
 - b. NEMA TC-2
 - c. UL listed in accordance with Article 347 of the NEC for exposed use.
 - 2. Flammability rated as self-extinguishing and have the following minimum properties:
 - a. Tensile strength ASTM D 638 at 78 degrees F: 6,000 psi.
 - b. Flexural strength, ASTM-D 790: 11,000 psi
 - c. Compressive strength, ASTM D 2240
 - 3. Fittings for EPC-40-PVC conduit shall meet the requirement of NEMA TC 3.
 - 4. The conduit and fittings shall carry a UL label on each 10-foot length of conduit and stamped or molded on every fitting.
 - 5. Conduit, fittings and cement shall be produced by the same manufacturer to assure system integrity.
- B. Non-Metallic Conduit (Underground)
 - 1. Shall be heavy wall high impact strength rigid PVC conforming to the requirements of:
 - a. EPC - 80-PVC conduit
 - b. NEMA TC 2
 - c. UL listed in accordance with Article 347 of NEC for underground use
 - 2. Fittings for EPC-80-PVC conduit shall meet the requirements of NEMA TC 3.
 - 3. The conduit and fittings shall carry a UL label on each 10-foot length of conduit and stamped or molded on every fitting.
 - 4. Conduit, fittings and cement shall be produced by the same manufacturer to assure system integrity.
- C. Liquidtight, Flexible Metal Conduit, Fittings and Couplings

1. Liquidtight, flexible metal conduit shall be LA-LOR as manufactured by Electri-Flex Company or equal.
 2. Fittings used with the flexible metal conduit shall be screw-in type as manufactured by Crouse Hinds Co., Raco or equal.
- D. Wiring Troughs
1. Shall be UL type 4.
 2. Covers and bodies shall be fiberglass.
 3. Sealed seams with no holes or knockouts.
 4. Gasketed cover with captivated screws.
 5. Size as noted on the Drawings.
- E. Boxes and Fittings
1. Shall be fiberglass reinforced.
 2. Terminal boxes, junction boxes, pull boxes, etc. shall be Schedule 40 fiberglass unless otherwise shown on the Drawings. Covers shall be gasketed and fastened with stainless steel screws.
 3. Conduit hubs shall be as manufactured by Appleton Electric Co., Rayco or equal.
- F. Conduit Mounting Equipment
1. All bolts, screws nuts, washers and etc. shall be stainless steel.
 2. All wall hangers, clamps and etc. shall be non metallic. If non-metallic is not available on certain items, PVC coated hardware will be acceptable field applied PVC coatings shall not be acceptable.
 3. All threaded rod shall be stainless steel and no smaller in diameter than 3/8 inch.
 4. Unistrut shall be 1 5/8 inch in width and be hot dipped galvanized.
- G. Conduit Seals
1. Conduit wall sleeve seals shall be Link-Seal as manufactured by Thunderline Corp.
 2. Bolts and nuts shall be stainless steel.
- H. Sleeves
1. Shall be hot-dipped galvanized sized to accept the proper conduit seal.
- I. Hazardous rated materials required in chemical area.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General
1. All non-metallic conduit and fittings shall be solvent cemented in accordance with the written manufacturer's instructions.
 2. Install in accordance with Article 352 of the NEC.
 3. No conduit smaller than 1/2-inch electrical trade size shall be used, nor shall any have more than three 90-degree bends in any one run. Pull boxes shall be provided as required or directed.

4. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.
5. The ends of all conduits shall be tightly plugged to exclude dust and moisture until wire is pulled. Immediately after pulling any wire, the box and enclosure covers shall be installed.
6. Conduit supports shall be spaced:
 - a. Rigid non-metallic in compliance with Article 352 of the NEC.
 - b. Rigid metal in compliance with Article 344 of the NEC.
7. Single conduits shall be supported by one-hole pipe clamps with back plates designed to raise the conduit from the surface. Multiple runs of conduits shall be supported on Unistrut members supported with threaded rod.
8. All conduits on exposed work shall be run at right angles to and parallel with the surrounding wall. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduits shall be run perfectly straight and true.
9. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.
10. Conduit terminating in non-metallic boxes shall have terminal adapters (threaded ended by socket end).
11. Conduit terminating in gasketed enclosures shall be terminated with conduit hubs.
12. Conduits shall be installed using threaded fittings.
 - a. Wherever raw metal is exposed on the conduit (cutting of threads), the exposed metal shall be cleaned and given a coat of ZRC cold galvanizing compound.
13. Liquid-tight flexible metal conduit shall be used for all motor terminations and other equipment where vibration is possible.
14. Signal Conduits
 - a. Signal conduits shall be separated from power conduits by a minimum of four (4) inches where possible runs shall cross each other at right angles.
 - b. Signal circuits shall not be contained in the same raceway of boxes with power, lighting or control circuits.
 - c. Signal circuits within equipment enclosures shall be separated from power, lighting or control circuits by containing the signal circuit in metal raceway.
15. Secure continuous grounding by bonding conductor throughout conduit systems.
16. Conduits shall be placed with minimum horizontal direction of travel. Vertical travel is the preferred direction. Conduit shall travel vertical through the ceiling and travel horizontal along the masonry wall in the ceiling. Plenum conduits shall not be run diagonally across the top of the ceiling.
17. Conduit travel is restricted in areas that will compromise the architecture structure of the building.
18. Provide touch-up compounds for coated raceways. In the event the PVC coated metal is damaged during raceways installation.

3.2 CLEANING

- A. Rod and swab embedded conduit after concreting and masonry work have been completed. If obstructions are encountered which cannot be removed, or if any condition exists which may result in damage to wires and cables pulled through the conduit, install a new conduit run at a location approved by the Engineer at no additional cost to the Owner.

3.3 CONDUIT OR RACEWAY ASSIGNED FOR FUTURE

- A. In each conduit or raceway assigned for the future, pulling in of wires include a nylon drag cord or equal pull line that can be left in conduit for future use and will not rot or mildew.

3.4 CONDUIT OR RACEWAY ASSIGNED AS SPARE

- A. In each conduit or raceway assigned, as spare or future use shall have pull line and cap appropriate for size of conduit or raceway to prevent undesirable material entering.

END OF SECTION

SECTION 16119

UNDERGROUND DUCTS AND UTILITY STRUCTURE

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to install a complete underground system of power and communication ducts as herein specified and shown on the Drawings.

1.2 RELATED WORK NOT INCLUDED

- A. Excavation and backfilling, including gravel and sand bedding, is included in Division 2.
- B. All concrete and reinforcing steel for duct encasement is included under Division 3.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Ducts shall be polyvinyl chloride conduit encased in concrete.
- B. Ground rods and other grounding materials and methods shall be as specified under Section 16450.
- C. Cable racks, supports, pulling-in irons, handhole steps, and hardware shall be galvanized steel.
- D. Precast handholes shall be heavy-duty type, designed for a Class H20 wheel load and conform to ASTM designation C-478. Precast handholes shall be as manufactured by Chase Precast Co., or equal and constructed to approximate nominal dimensions shown on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Ducts shall be installed to drain away from buildings. Duct slopes shall not be less than 3-inch per 100-feet.
- B. Ducts shall be encased in reinforced concrete.
- C. The minimum cover for ducts shall be 24-inch unless otherwise permitted by the Engineer.

- D. Duct entrances to buildings and structures shall be made with steel conduit not less than 10-feet long.
- E. Handholes shall be installed as indicated on the Drawings.
- F. Rigid steel conduit shall be used for risers at service poles and at other locations shown on the Drawings.
- G. Where bends in ducts are required, long radius elbows, sweeps and offsets shall be used.
- H. All ducts shall be swabbed clean before cable installation.
- I. A nylon pull wire or equivalent approved for pulling applications shall be left in all spare or empty ducts.
- J. Plastic spacers shall be used to hold ducts in place. Spacers shall provide not less than 2-inch clearance between ducts. Spacers shall be installed 4-feet apart.
- K. Duct terminations at handholes shall be with end bells.
- L. Spare ducts shall be plugged and sealed watertight at all handholes, buildings and structures.
- M. Ducts in use shall be sealed watertight at all handholes buildings and structures.
- N. Pulling-in irons shall be installed opposite all duct entrances to handholes.
- O. Cables shall be trained in handholes and supported on racks and hooks. Furnish inserts on all handhole walls for mounting future racks as well as racks required for present installation.

END OF SECTION

SECTION 16120

WIRES AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide all wire, cable and appurtenances as shown on the Drawings and as specified herein.
- B. Refer to Section 16000: General requirements for electrical work.
- C. Furnish all labor, materials, services, equipment and appliances required in connection with providing wire and cables for the building and associated connections for utility connection.

1.2 APPLICATIONS

- A. Except as otherwise noted on the drawings or hereinafter specified, the electrical conductors shall be copper, and conform to ASTM B-3 of soft annealed copper, the following shall apply:
 - 1. Building wire and cable shall be copper with 600 V insulation, THWN for branch circuitry and XHHW for feeders.
 - 2. Conductors shall be of soft drawn 98% minimum conductivity properly refined copper and stranded construction for all conductors.
 - 3. Exterior of wires shall bear repetitive markings along their entire length indicating conductor size, insulation type and voltage rating.
 - 4. Exterior of wires shall be color-coded, so as to indicate a clear differential between each phase and between each phase and neutral. In all cases, grounded neutral wires and cables shall be identified by the colors white or gray. In sizes and insulation types where factory applied colors are not available, wires and cables shall be color coded by the application of colored plastic tapes in overlapping turns at all terminal points, and in all boxes in which splices are made. Colored tape shall be applied for a distance of 6 inches along the wires and cables, or along their entire extensions beyond raceway ends, whichever is less.
 - 5. Final connections to motors shall be made with 18-inches of neoprene sheathed flexible conduit.
 - 6. Minimum branch circuit conductor size shall be No. 12 AWG installed in conduit. Motor control circuit wiring shall be minimum No. 14 AWG installed in conduit.

7. Fire alarm and security system wiring shall be No. 16 twisted non-shielded pairs for alarm and trouble circuits and a minimum of #14 AWG for device power, control and alarm annunciation circuits.
8. Other wires and cables required for the various systems described elsewhere in this Section of the Specifications shall be as specified herein, as shown on the Contract Drawings, or as recommended by the manufacturer of the specific equipment for which they are used all installed in conduit.

1.3 COLOR CODING OF CONDUCTORS

- A. Color code all supply cables and branch circuit conductors throughout the secondary alternating current wiring system as follows:

1.	<u>Conductor</u>	<u>480Y/277 Volts</u>	<u>120/208 Volts</u>
		Three Phase Y	Three Phase
	Phase A	Brown	Black
	Phase B	Orange	Red
	Phase C	Yellow	Blue
	Neutral	Gray or White	White or Gray
	Ground	Green w/yellow strip	Green

2. Color code 120/240 volt, single phase as follows:
 - a. Phase A - Black - - - Phase B - Blue or red.
3. Branch circuit phase conductors No. 10 and smaller and all neutral and equipment conductors: Solid color insulation or solid color coating.
4. Solid color coatings and tracers: A strongly adherent paint or dye not injurious to the insulation and which will not be obliterated by pulling into a conduit or raceway.
5. On-site coloring of ends of conductor may be permitted by the Engineer upon receipt of satisfactory evidence that the Contractor is unable to order color-coded wire and cable as specified. Provide certification from the cable manufacturer that the paint or dye proposed for field application is non-injurious to the insulation. Colored tape may be used to mark the ends of conductors in lieu of paint or dye.

1.4 CONDUCTOR MARKINGS

- A. All conductors shall bear the markings of the Underwriter's Laboratories, the AWG size, the type of insulation, maximum permissible voltage, the manufacturers name and trademark.

1.5 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

- B. Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer two copies of an operation and maintenance manual complied in accordance with the provisions of Section 01730 of these Specifications.
- C. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.6 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. A complete parts list for all equipment furnished under this Section.

1.7 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Conductor Sizes: Standard American wire gauge sizes.
 - 1. All conductors shall be stranded copper.
 - 2. Copper shall be soft drawn copper.

2.2 600 VOLT WIRE

- A. Type XHHW shall be cross-linked polyethylene as manufactured by American Insulated Wire Corp., General Electric Co. or equal.
- B. Type THWN shall have PVC insulation with a nylon jacket as manufactured by American Insulated Wire Corp., General Electric Co., or equal.
- C. Type RHH shall be cross-linked polyethylene as manufactured by American Insulated Wire Corp., General Electric Co. or equal.

2.3 INSTRUMENTATION CABLE

- A. Instrumentation wire shall be twisted pair construction, multiple pair series with individual and overall shield and PVC jacket. Minimum of 6 pairs AWG size 18 cable, UL listed. In the event the instrumentation provided will not accommodate AWG size, a smaller than a #18 AWG cable can be used.
- B. Instrument leads, wires and cables furnished under Section 13310 and under other Divisions of these Specifications shall be installed under this Section.

2.4 BARE COPPER

- A. Bare copper wire shall be stranded, Class B manufactured from soft annealed copper.

2.5 CONNECTORS

- A. Compression connectors shall be rated for 600 volts and vinyl insulated as manufactured by Burndy or equal.

2.6 WIRE AND CABLE MARKERS

- A. Wire and cable markers shall be "Omni-Grip" as manufactured by W.H. Brady Co. or equal.
- B. Wire and cables with diameters exceeding the capacity of the "Omni-Grip" shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by W.H. Brady Co. or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Conductors shall be installed as follows:
 - 1. Handled carefully to avoid kinks or damage to the insulation.
 - 2. Lubricants used to facilitate wire pulling shall be UL approved for the specified insulation.
 - 3. All wire and cable shall be continuous and without splices between points of connection to equipment terminals.
 - 4. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.
 - 5. Shielded instrumentation wire shall be installed in rigid conduit and pull boxes that contain only shielded instrumentation wire.
 - 6. Shielding of instrumentation wire shall be grounded at the transmitter end only.
 - 7. All wiring terminations shall be uniquely identified at each end with wire and cable markers.

3.2 TESTS

- A. All 600-volt wire insulation shall be tested with a megohm meter after installation. Tests shall be made at no less than 500 volts.
- B. When required by the Engineer, such tests shall be performed in his presence. Before conducting tests, a written outline of the methods and equipment to be used shall be submitted to the Engineer for approval. All test equipment shall be provided by the Sub-Contractor.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Section 16000: General requirements for electrical work.
- B. Furnish and install with all labor, materials, services, equipment and all necessary accessories and appurtenances required herein after specified and shown on the Drawings for the following:
 - 1. Switches
 - 2. Receptacles
- C. In general, the switches and receptacles are interrelated with panelboards, transformer and lighting fixtures provide a complete system.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Conduit
 - 1. Shall be as specified under Section 16110.
- B. Wires and Cables
 - 1. Shall be as specified under Section 16120.

2.2 SWITCHES

- A. Wall switch for outside lights shall be of the toggle action, lighted toggle (light on with load off), flush mounting, quiet type 20 ampere. Switches shall conform to Federal Specifications WS8956-E.
 - 1. Wall switches shall be the following types or equal:
 - a. Single pole - Hubbell HBL 1221IL.
- B. Wall switches for inside lights shall be equal to Hubbell light hawk multi tech occupancy/vacancy sensor.
 - 1. Switch shall include passive infrared, ultrasonic and dual technology occupancy sensors.
 - 2. Switch to have manual activation switch to override sensor.
- C. Receptacles (Interior and Exterior)
 - 1. Wall receptacles, ground fault circuit interrupting (GFCI,) shall be the following types or equal.
 - a. Duplex, 20A, 125 volt, 2-pole, 3-wire, Hubbell GF 201L.
- D. Device Plates
 - 1. Plates for wall mounted devices shall be of the required number of gangs for the application involved, shall be weatherproof non-metallic covers for receptacles and toggle switch cover for switches equal to Carlon rigid non-metallic weatherproof covers and shall be of the same manufacturer as the device box for proper fit.
 - 2. Provide pre-marked wall plates, nylon for "GFCI" receptacles Hubbell Catalog Number PJ8GF1W or equal.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION

- A. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for connection.
- B. Fixtures to be installed flush, shall be complete with the proper accessories for installing. All flush mounted fixtures shall be supported from the structure.

3.4 TESTING

- A. Test all receptacles and switch outlets. Repair or replace all defective and or malfunctioning components. Make all necessary adjustments to individual components and system settings.
- B. Instruct the Owner's personnel in the proper operation of the system.

END OF SECTION

SECTION 16191

MISCELLANEOUS EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Refer to Section 16000: General requirements for electrical work.
- B. Furnish all labor, materials, services, equipment and appliances and test all miscellaneous equipment as shown on the Drawings and as specified herein.
 - 1. Transformer
 - 2. Fan control panel
 - 3. Fan receptacle and plug
 - 4. Room thermostat

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Upon completion of this portion of the Work, and as a condition of its acceptance, deliver the copies of an operation and maintenance manual compiled in accordance with the provisions of Section 01730 of these Specifications.
- C. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. A complete parts list for all equipment furnished under this Section.
 - 3. All manufacturers' catalog cuts and technical literature, which clearly show the proposed products are in conformance with these Specifications.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - EQUIPMENT

2.1 DRY TYPE TRANSFORMERS IN GENERAL

- A. Transformers shall be 115 degrees C temperature rise above 40 degrees C ambient.
 - 1. Transformer shall be capable of carrying a 15% continuous overload without exceeding a 150 degree C rise in a 40 degree C ambient.
 - 2. Transformer to be a minimum "K-13" rating.
- B. All insulating materials shall be suitable for 220 degrees C U.L. component recognized insulation system.
- C. Coils: Coil conductors to be continuous with terminations welded without auxiliary flux material.
 - 1. Wind coils with copper or aluminum magnet wire, vacuum impregnated with non-hydroscopic, thermosetting varnish.
 - 2. Coils to be protected with an outer layer of glass tape or similar quality insulation.
 - 3. Provide each layer with end fillers or tie-downs to ensure maximum mechanical strength.
 - 4. Brace tap terminations to magnet wire.
 - 5. Brace primary and secondary magnet wire directly to bus stud or lugs.
 - 6. Windings shall be continuous with no splices.
- D. Core
 - 1. Manufacture core from a high-grade, non-aging 29 gauge silicon steel with high magnetic permeability, low hysteresis and eddy current losses. Keep magnetic flux densities well below saturation to allow for a minimum of 10 percent over-voltage excitation.
 - 2. Cut laminations with the direction of the grain and free from burrs.
 - 3. All laminations must be core plated or annealed and firmly butted.
 - 4. The core laminations shall be clamped tightly and compressed to provide quiet operation and to prevent damage during shipment or rough handling.
- E. Taps: Provide NEMA standard taps.
- F. Enclosures:
 - 1. Provide lifting brackets on all sizes.
 - 2. Ventilated openings shall be such as to avoid accidental access to live parts.
 - 3. Degrease, clean, phosphatize and paint the entire enclosure with one (1) coat of zinc chromate primer and two (2) coats of gray enamel.
- G. The core and coil assembly shall be grounded to the enclosure by means of a flexible copper grounding strap of adequate size.
- H. Mounting: Provide transformers suitable for floor.

- I. Vibration Isolation: Core and coil assemblies 25 KVA and larger to be mounted on rubber vibration isolators designed specifically to reduce 120 Hz sound and multiple harmonics.
- J. All transformers shall be of the quiet type, operating at sound levels substantially below ANSI standards as follows:

SIZE IN KVA	SPECIFICATION	ANSI STANDARD
0-5	33	40
6-9	37	40
10-25	40	45
26-50	45	45
51-150	45	50
151-225	45	55
226-300	48	55
301-500	55	60

K. General:

1. Where indicated or as otherwise required and/or approved, resiliently suspend each dry type transformer on double deflection neoprene in the shear hanger rod isolator assemblies, capable of providing minimum 3/8-inch static deflection.
2. The transformers are to be floor mounted installed on concrete housekeeping pads. Provide neoprene pads between transformers and housekeeping pads.
3. Provide grounding conductor from transformer secondary to nearest building ground for each separately derived system.
4. Flexible conduit shall be used for all conduit connections to transformers; provide external bonding wire.
5. Adjust transformer tape for rated output voltage under normal operating conditions.
6. Transformer to power panelboard circuits in motor control center.
7. Approved Manufacturers:
 - a. All transformers are to be the same manufacturer.
 - b. Subject to compliance with requirements provide products by one of the following or equal:
 - i. General Electric
 - ii. Square D
 - iii. Cutler-Hammer
 - iv. Siemens ITE

2.2 FAN CONTROL PANEL

- A. Control Panel
 - 1. Provide fan control panels in non-metallic enclosure or stainless steel including but not limited to the equipment identified on the Drawings and identified below:
 - a. Primary and secondary fusing of control transformer
 - b. Control transformer sized for application
 - c. Hand-Off-Auto 3-position selector switch
 - d. Relays to be din rail mounted 15 amp rated, 240 VAC with indicating light and manual operator
 - e. Terminal blocks for incoming and outgoing signals
 - f. All pilot devices to be UL listed, water/oil tight suitable for 30.5 mm mounting.
 - g. Indicating lights shall have LED lamp and rated 120 volts with push-to-test.
 - h. Include legend plate for pilot devices
 - i. Include phenolic nameplate for each control panel
 - j. Disconnect switch with exterior operator
 - k. Cam switch to control high/low speed selection
 - l. Thermal overload relay for motor protection
- B. Event timer: Provide a 24-hour single channel electronic time control. The unit is designed to switch a single load on and off. Twenty-four hour programming providing 288 events (one event every 5 minutes), LCD display of time of day, day of week and output status. One SPDT output relay rated 15 amps. Provide unit with lithium battery for power outage carryover. Control shall be din rail or surface mountable, Paragon Electric Company, Model No. EC11D/120 or equal.

2.3 FAN RECEPTACLE AND PLUG

- A. Fan receptacle shall be 250 volts, 2 pole, 3 wire equal to Hubbell twist lock system Model HBL 2620AR 30 amp twist lock receptacle, mounted in non-metallic enclosure.
- B. Fan plug shall be 250 volts, 2 pole, 3 wire, 30 amp twist lock plug equal to Hubbell twist lock system Model HBL 2621 installed on a 3 wire power cord and connected to fan motor.

2.4 ROOM THERMOSTAT

- A. Room thermostat for fan control panel to be equal to Chromalox Model WCRT-100.
 - 1. Unit to be UL listed.
 - 2. Unit to include a snap action switch.
 - 3. Weatherproof (NEMA 4X) enclosure.
 - 4. Adjustable knob for temperature setting.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION

- A. Installation shall be in strict accordance with the best practice of the involved trades and with the respective manufacturer's instructions and recommendations.
- B. Electrical Connection
 - 1. Electrical connections shall be made under Division 16, except to instrumentation equipment inside instrumentation enclosure. All connections to instrumentation shall be completed under Section 13310.
 - 2. Provide all necessary conductors, conduits, bushings, couplings, support cups, straps and hardware required by the National Electrical Code to provide complete electrical connection including all interconnections between the devices specified and their line, load and control function.

3.4 ENTRANCE EQUIPMENT

- A. The entrance equipment shall be tested to indicate proper function.

3.5 TESTING REQUIRED FOR ALL MISCELLANEOUS EQUIPMENT

- A. Each device shall be tested to verify all components function mechanically and electrically and perform function intended.
- B. All devices that have interwiring connectors shall be tested to verify external signals activate and deactivated as indicated on the Drawings.
- C. Provide all necessary and required assistance from manufacturer of equipment during start-up.

END OF SECTION

SECTION 16450

GROUNDING SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide a complete grounding system in strict accordance with Article 250 of the National Electric Code (NEC) and as shown on the Drawings and specified herein. In certain locations the grounding conductors are larger than the NEC requirements. The larger grounding conductors are required and shall be provided to safely carry the short circuit current.
- B. Refer to Section 16000: General requirements for electrical work.
- C. Furnish all labor, materials, services, equipment and appliances required in connection with providing a grounding system per NEC and Town code.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. A complete parts list for all equipment furnished under this Section.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Provide a grounding system that includes all connections and testing of: ground rods, ground cables, ground buses, conduits, fittings, anchors, supports, exothermic welding materials and equipment, and other materials as required for a complete installation.
- B. Provide ground cables composed of stranded bare copper of 98 percent conductivity encased in non-metallic conduit above grade. Cable to be buried below frost level, but not less than 12 inches below grade. Install as required to provide sufficient mechanical protection.
- C. All copper to copper and copper to steel connections of #6 AWG and larger shall be made with the exothermic welding process except as noted in Item D, below.
- D. Provide Burndy Corp., Type NE, Thomas & Betts Co., Inc., Catalog No. 3951 or approve equal, ground fittings for bonding ground cable to encasing metal conduit.
- E. Provide exterior round enclosure 36-inches high by 36-inches diameter base with tapered footing design. Enclosure cover 27 inches in diameter with the words "GROUND" as the cover logo. Erico Catalog No. T416A or Quazite Part No. PR 2700 HA 00 or equal.
- F. Provide copper plate for cable and ground rod common connection. Erico Catalog No. CRC16EK (#200) and ground bar Erico Catalog No. B542C003 or equal.
- G. Provide cable to lug connectors, Erico Type GL or equal.
- H. Provide Erico ground enhancement material (GEM[™]) or equal to improve system resistance as backfill material in the augered hole for the ground rod.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All systems, circuits, equipment, motor and transformer frames, enclosures, conduits, cable armor, instrument and control power transformers, instruments, meters, relays, metal structures, supports, and all other equipment and materials required by the NEC to be grounded shall be grounded and bonded in accordance with the NEC.
- B. Shields and drain wires of shielded cables shall be grounded in accordance with instructions and recommendations of the manufacturer of the particular item of wire and cable.
- C. Conduits stubbed into a motor control center shall be fitted with insulated grounding bushings and connected to the motor control center ground bus. The grounding wire shall be sized in accordance with Table 250-95 of the National Electrical Code, except that a minimum No. 12 AWG shall be used.

- D. The incoming secondary lines shall be grounded at the bottom section of the enclosure which they enter.
- E. Auger 3-inch diameter hole for each rod to a depth of 7'-6". Place rod in hole and drive rod into bottom of hole. Make ground connections. Premix manufacturers recommended amount of ground enhancing material into a slurry and fill hole and tamp around rod to insure hole is completely full. Fill remainder of hole around rod with augured soil.
- F. The motor control centers shall be grounded to the nearest available grounding electrode.
- G. Lighting transformer neutrals shall be grounded to the nearest available grounding electrode.
- H. Ground electrical work in accordance with NEC Article 250, local codes as specified herein, and as shown on the Drawings.
- I. Install ground cables continuous between connections. Splices will not be allowed except where indicated on the Drawings. Connections made by the exothermic welding process are not considered splices. Where ground cables pass through floor slabs, building walls, etc., and are not in metallic enclosures, provide the sleeves of approved non-metallic material.
- J. Use rigid metal conduit and electric metallic tubing as equipment grounding conductors. Make-up couplings wrench tight. Install grounding conductor in non-metallic raceways and under floor ducts.
- K. Install equipment grounding conductors in non-metallic raceways.
- L. Ground interior lighting fixtures with grounding conductors to rigid metal raceways serving them. Flexible metal conduit in lengths less than 6 feet 0 inches may be used as grounding conductors when terminated with approved fittings on circuits of 20 amperes or less.
- M. Where connections are made to motors or equipment with flexible metal conduit, grounding conductor shall be stranded copper conductor within the conduit, bonded to the equipment and to the rigid metal raceway system. Size conductor in accordance with NEC Table 250-122.
- N. At each convenience outlet, install a grounding clip attached to the outlet box and leave a sufficient length of #12 wire with green colored insulation to connect to the grounding terminal of the receptacle. Grounding clip shall be equal to Steel City Type G. This requirement may be deleted if automatic grounding clip receptacle meeting NEC Article 250.

- O. Care shall be taken to insure good continuity, in particular, between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed. A code sized grounding conductor shall be included in all conduits and bonded to equipment frames at each end.
- P. Insulated copper wire equipment grounding conductors shall be run with circuit conductors or where PVC conduit is used.
- Q. Liquid tight flexible metal conduit in sizes 1 1/2-inch and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel and fastened with plastic tie wraps.
- R. All telemetry and instrumentation equipment shall be grounded separate from electric power equipment to prevent power interference.
- S. SCADA instrumentation equipment requires a separate ground. Each device shall be connected to an effective earth ground such as a ground rod, in moist soil. Do not use neutral terminals on lighting panels, water pipes or conduit as ground. It is the responsibility of the electrical contractor to install a proper ground system for the telemetry equipment to assure trouble free operation of the equipment.
- T. A common ground rod shall be established with a housing for the ground rod and three connection points, 1 - Power, 2 - TVSS, and 3 - Instrumentation/communication. The ground rod will be backfilled with a ground enhancement material, GEM by Erico or equal.

3.2 INSTRUMENTATION GROUNDING

- A. SCADA Panel, Well Level and Flow Meter
 - 1. Provide No. 6 AWG THAW in 1/2-inch conduit to new ground rod.

3.3 TRANSIENT VOLTAGE SURGE SUPPRESSORS

- A. Transient voltage surge suppressor shall be grounded separately. The ground connection provides a direct path to discharge any faults to ground.

3.4 TESTS

- A. Test the ground resistance of the system. All test equipment shall be provided under this Section. Dry season resistance of the system shall not exceed five ohms. If such resistance cannot be obtained, additional grounding shall be provided as directed by the Engineer.
 - 1. Ground resistance measurements of each ground rod shall be taken.
- B. All ground resistance measurements shall be made with a three-terminal "megger"-type ground tester which applies alternating current to the electrodes and which gives a reading in direct current ohms.

- C. Measure ground grid resistance with earth test megger and install additional ground rods and conductors as required until resistance to ground complies with job requirements and with the NEC requirements as maximum.

3.5 COORDINATION

- A. Coordinate the work under this Section with the work under Divisions of the Specifications.

END OF SECTION

SECTION 16000

ELECTRICAL – GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SUB-BID REQUIREMENTS

- A. In accordance with "Massachusetts General Laws, Chapter 149, Section 44A through 44L inclusive as amended", the Engineer declares that all of the work of this Division shall be estimated under the appropriate Item of Part II of the Form for General Bid, and that each sub-bidder on this work shall submit his bid and bid security as detailed in the Advertisement.
 - 1. Details for the procedure for filing sub-bids are contained in the Instructions to Bidders.
 - 2. The Work of this Division is shown on Drawings E1-E8, summarized in Section 01010, 02070 and Division 16 Specifications.

1.2 DESCRIPTION

- A. Work included: The work to be done under this Division includes but is not limited to all wiring and equipment for the new Springvale No. 4 Pump Station and the controls for the Backwash Tank System.
- B. Related Work:
 - 1. Documents affecting work of this Division include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.
- C. Connections
 - 1. The electrical sub-contractor shall provide the necessary devices to make connections to equipment furnished by other Sections and not necessarily limited to the above mentioned Sections.
 - 2. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Division shall be furnished at no extra cost.
- D. Scope of Work
 - 1. See Section 01010 for new work and Section 02070 for demolition work.

1.3 QUALITY ASSURANCE

- A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Division.

- G. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: within twenty-five (25) calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. A complete parts list for all equipment furnished under this Section.
 - 3. Equipment outline drawings showing elevation and plan views, dimensions, weights and shipping splits. Indicate all options, special features, ratings and deviations from the specifications.
 - 4. Unit summary tables showing detailed functional description and nameplate data for each compartment.
 - 5. Product data sheets and catalog numbers for motor controllers and circuit breakers. List all options, trip adjustments, and accessories furnished specifically for this Project.
 - 6. Provide control systems engineering to produce custom unit elementary drawings showing interwiring and interlocking between units and to remotely mounted devices. For each motor controller, provide one control schematic (ladder diagram) which shows all of the information shown on the control schematics on the Electrical Drawings, including the equipment tag number and name. Each control schematic shall show wire and terminal numbers.
 - 7. Itemized list of spare parts furnished specifically for this Project, including quantities, description, and part numbers.

1.4 SPARE PARTS

- A. The following spare parts shall be furnished.
 - 1. 1 can of aerosol touch-up paint.
 - 2. 100 percent replacement fuses, all types and sizes.
 - 3. 100 percent replacement lamps for pilot lights.
 - 4. 1 of each color replacement lens cap for pilot lights.
 - 5. 2 spare of each type of control relay and control timers furnished.
 - 6. 3 replacement overload heaters of each size used.
- B. Spare parts shall be boxed or packaged for long-term storage. Identify each item with manufacturer's name, description, and part number on the exterior of the package.

1.5 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 RATING

- A. The motor control centers shall be designed for 480 volts, 3 phase, 4-wire Delta system 60 Hz service. The incoming service is a 3-wire service from the existing electrical switchgear on the side.
- B. The overall short circuit withstands rating of the equipment and devices shall be 42,000 amperes R.M.S. symmetrical at 480 volts. Main and feeder circuit protective devices shall be fully rated for the specified short circuit duty. Systems employing series connected ratings for main and feeder devices shall not be used. Motor starter units shall be tested and UL labeled for the specified short circuit duty in combination with the motor branch circuit protective device.
- C. Motor control centers, including devices, shall be designed for continuous operation at rated current in a 40 degree C ambient temperature.

2.2 CONSTRUCTION

- A. Motor control centers shall consist of a series of metal enclosed, free-standing, dead front vertical sections bolted together to form double wall construction between sections.
 - 1. Individual vertical sections shall be nominally 90- inches high, 20-inches wide, and 20-inches deep unless otherwise shown on the Drawings. Removable bottom channel sills shall be mounted front and rear of the vertical sections extending the full width of each shipping split. Top of each section shall have removable plates with lifting angle. Make provisions for field installing of additional sections to either end. The enclosures shall be NEMA Type 12.
 - 2. The motor control centers shall contain individual plug in compartments, which shall be isolated from each other by separate horizontal steel plates or by steel plates which are an integral part of the compartment itself which has no openings.
 - 3. Vertical sections shall be mounted on steel channel sills continuous on four sides, or with steel channel sills on two sides and end cover plates. Each compartment shall be provided with a hinged door of pan construction on the front and a door opening of sufficient size to permit ready removal of any of the equipment in the compartment. Interlocks shall be provided to prevent opening the compartment door when the disconnect device in the compartment is in the closed position. An interlock bypass device shall be furnished. Means of locking the disconnect device in the "Off" position shall be provided. Disconnect device operating mechanism shall not be attached to the compartment door.
 - 4. All sections shall have the same structural features with provisions for the addition of similar sections at either end. Each compartment shall meet NEMA Standards for the control equipment installed and units of similar size shall be interchangeable.

5. Each section shall be provided with a horizontal wiring space which shall line up with a similar space in the adjacent section or sections, with openings between so that wires may be pulled the entire length of the control centers. There shall also be provided in each section a vertical wiring space with separate full height door. The wiring space shall be provided with suitable wire containment devices. Suitable protective insulating grommets shall be provided to protect the wiring insulation.
6. The motor control centers shall be designed for against-the-wall mountings. All wiring, bus joints and other mechanical parts requiring tightening or other maintenance shall be accessible from the front or top.
7. The motor control centers shall have engraved laminated nameplates screwed to the doors of each individual compartment and wiring diagrams pasted inside each door. Compartments containing panelboards shall have a cardholder on the inside of the door. Compartments containing motor starters shall each have an overload heater selection table pasted inside the door.
8. The motor control centers shall provide equipment of type, capacity and trip ratings for the loads shown on the Drawings or otherwise specified. Minimum starter size shall be NEMA-1.
9. Construction shall be NEMA Class II-S, Type C. In so far as possible all devices and components used shall be of one manufacturer. The motor control centers shall be furnished as a completely factory assembled unit where transportation facilities and installation requirements permit.
10. The motor control centers shall be finished with ANSI Z55.1, No. 61 light grey enamel over a rust resistant primer.
11. Master terminal block shall be at top of vertical sections. Master terminal block assemblies shall be removable utilizing mounting rails with quick release fastener.
12. Provide thermostatic controlled space heaters per structure as required to ensure proper operation and prevent condensation.
13. Provide individual, flange formed, pan type door with concealed hinges and quarter turn latches for each device compartment and future space. Doors shall be removable. Door removal shall not be required to withdraw starter units or feeder tap devices.
14. All covers, doors, and openings shall be gasketed to meet UL/NEMA Type 12 requirements, unless otherwise shown on the Drawings.

B. Buses

1. All buses shall be silver-plated copper. A continuous main horizontal bus shall be furnished. Main buses shall be rated as shown on the Drawings, but shall not be less than 600 amperes.
2. Each vertical section shall have a full height vertical bus silver-plated copper rated as required, but not less than 300 amperes. Vertical buses shall be insulated and isolated with glass polyester or equivalent continuous insulation. Taped buses will not be acceptable. Unused stab openings shall be plugged. Lower ends of vertical buses shall be insulated.
3. A 1/4-inch x 2-inch silver-plated copper ground bus shall be furnished the entire length of the motor control center.

4. Buses shall be braced for 42,000 amperes RMS, symmetrical, short circuit current.
 5. All buses except neutral and ground buses shall be completely isolated by steel plates or insulating material.
 6. Where spaces for future equipment are called for on the Drawings, such positions shall be equipped with buses, bus stab receptacles, unwired terminal blocks and blank doors of the sizes indicated.
- C. Wiring
1. All of the wiring shall be copper.
 2. Compartment wiring shall be to compartment mounted, plug-in terminal blocks that allow compartments to be withdrawn without having to remove wires from fixed terminal blocks.
 3. All interior line voltage and control wiring shall be color-coded, racked, bound and numbered on each end with clip on type labels and terminated in numbered terminal strips. Wires shall be terminated with insulated ring-tongue type connectors.
 4. All wires shall be labeled at each end, with wrap around markers identifying each conductor.
- D. Unit Compartments
1. Provide individual, removable, unit device compartments for each combination starter unit and each single or duplex feeder tap device. Each vertical section shall accommodate a maximum of six unit compartments. Steel barriers shall isolate the top, bottom, and sides of each unit from adjacent units and wireways. Units shall connect to the vertical bus in each section with tin-plated, self-aligning, pressure type copper plug connectors. Size 5 and larger starter units may be wired directly to the bus. Removable units shall be aligned in the structure on guide rails or shelves and secured with a cam latch mechanism or racking screw.
 2. Provide individual, isolated compartments for fixed mounted devices, cable lugs, metering, relaying, and control devices. Main and bus tie circuit breakers shall be bolted directed to the main horizontal bus. All bus connections shall be fully rated.
 3. Provide the following safety interlock features:
 - a. Provision to padlock removable units in a partially withdrawn TEST position, with the bus stabs disengaged.
 - b. Provision to padlock unit disconnect handles in the OFF position with up to three padlocks.
 - c. Mechanical interlock to prevent opening unit door with disconnect in the ON position, or moving disconnect to the ON position while the unit door is open.
 - d. Mechanical split-type terminal blocks for disconnecting external control wiring.
- E. Layout
1. Height of door mounted equipment and labels as measured from the finished floor level.

<u>Device</u>	<u>Minimum</u>	<u>Maximum</u>
Lamps	36"	78
Meters	48"	60
Touch Pads	48"	54
Manual Controls	36"	54

The Contractor shall coordinate the equipment layout and submit a sketch of their layout with the MCC submittals, for Engineer's approval.

2.3 COMPONENTS

A. Circuit Breakers

1. General

- a. Circuit breakers shall be one, two or three pole molded case circuit breakers rated 15 through 250 amperes, as specified on the Drawings. All circuit breakers shall be UL and CSA listed, IEC 157-1 rated, meet NEMA Standard AB1-1975 and Federal Specifications W-C-375B/GEN, when applicable. Breakers covered under this specification may be installed in panelboards, switchboards, individual enclosures, motor control centers, or combination motor starters.

2. Construction

- a. Molded case circuit breakers shall have over center toggle-type mechanisms, providing quick-make, quick-break action. Breakers shall be calibrated for operation in an ambient temperature of 40°C. Each circuit breaker shall have trip indication by handle position and shall be trip-free. Two and three pole breakers shall be common trip. Each circuit breaker shall be a permanent trip unit containing individual thermal and magnetic trip elements in each pole. Circuit breakers with frame sizes greater than 100 amperes shall have variable magnetic trip elements which are set by a single adjustment (to assure uniform tripping characteristics in each pole). A push-to-trip button shall be provided on the cover for mechanically tripping the circuit breaker. The circuit breaker shall have reverse connection capability and be suitable for mounting and operating in any position.

3. Terminations

- a. Circuit breakers shall have removable lugs. Breakers shall be UL listed for installation of lugs.

4. Circuit breakers shall have a minimum UL listed interrupting rating of 42,000 RMS symmetrical amperes at 480Y/277 volts.

5. Incoming line entry breaker (service entry)

- a. The breaker shall have a suitable for use as service entrance label. This breaker shall have a minimum UL listed interrupting rating of 42,000 amperes RMS symmetrical at 480 volts AC.

6. Auxiliary switches (three pole breakers only) provide factory installed auxiliary switches 2A/2B to monitor circuit breaker contact status and provide a remote signal indicating the circuit breaker contacts are open or closed. Auxiliary switch contact leads shall be brought to terminals and labeled.
 7. All 50-ampere frame and larger circuit breakers shall have shunt trip devices wired to the Automatic Transfer Switch so as to trip the circuit breaker off line if the Transfer Switch is connected to the generator. Each circuit breaker shall have a manual "Shunt Trip Cutout" switch to selectively disable shunt trip load shedding.
- B. Surge Capacitor and Surge Arresters
1. Provide, assemble and wire to the Service Entrance circuit breaker.
 - a. Surge capacitor rated 600-volt three-phase four wire with an internal automatic discharge circuit as manufactured by Delta Lightning Arresters Inc. Catalog Designation CA603R or equal UL listed unit.
 - b. Surge arresters rated 600-volt three-phase four wire 100,000 amps maximum current 1500 joules maximum energy as manufactured by Delta Lightning Arresters Inc., Catalog Designation LA603 or equal UL listed.
- C. Pushbuttons
1. Pushbuttons, indicating lights, selector switches, heavy-duty industrial rated water/oil tight (UL/NEMA 4, 4 x 13) without boots suitable for 30.5mm (1-13/64") mounting hole. Contact blocks contain 1NC and 1NO as a minimum. Each unit shall have legend plate, standard or custom type. Indicating lights shall be push-to-test – 120 VAC LED with lens color as designated on the Drawings.
- D. General Purpose Relays
1. The units shall be a square base with plug in blade style quick-connect solder termination.
 2. Relays shall be 3 pole (3 PDT) with contacts rated at 15 amps, provide manual operator and a pilot light integral with each relay Square D Company Catalog No. KX13M1P14 or equal.
- E. Timing Relay
1. The timing relay unit shall be a multi-function, multi-range timing relay with a plug-in tube base with pin style terminations. Contacts rated 5 amperes DPDT (2 form C) Square D Catalog 9050 type JCK70 or equal.
- F. Sockets and Accessories
1. Provide sockets with screw terminal for general- purpose relays and timers plus din rail mounting track for socket Square D Company Catalog No. NR82B and N62F (sockets) and NTB (din rail) or equal.
- G. Monitoring Device
1. The monitoring device shall be a microprocessor based monitoring and protective device which shall provide complete electrical metering and system voltage protection.

2. The monitoring device shall provide:
 - a. AC Ampere Phase A
 Phase B
 Phase C
 - b. AC Voltage

Phase A-B	Phase A neutral
Phase B-C	Phase B neutral
Phase C-A	Phase C neutral
 - c. Megawatts
 - d. Megavars
 - e. Power Factor
 - f. Frequency
 - g. Megawatt Demand
 - h. Megawatt Hours
3. The microprocessor-monitoring device shall be Underwriters Laboratories listed.

H. Panelboards

1. Surface mounted panelboard cabinets shall be of the dead-front safety-type, provided with the size and number of main, and single, double or triple pole branches as indicated in the schedule. Panels shall be equipped with bolt-on thermal magnetic molded case circuit breakers. Cabinets shall be constructed of zinc-coated sheet steel and shall conform to Underwriters Laboratories, Inc. Standards for Cabinets and Boxes. Trims, unless otherwise noted, shall be fitted with hinged doors having combination lock and latch with all locks keyed alike. Busses shall be copper. Provide full size neutral bar with lugs for each branch circuit space.
2. Furnish ITE, GE, Square D or Westinghouse products.
3. Provide full-size main bus. Provide separate neutral and ground buses. All buses shall be copper.
4. Breakers shall be thermal magnetic, bolt-on type. Short circuit rating shall be 22,000 amperes RMS symmetrical. Multi-pole breakers shall be common trip with single operating handle.
5. Panelboard cabinets shall be provided with trims having adjustable trim clamps.

I. Power Terminal Blocks

1. Copper power distribution blocks provided to coincide with cable size of incoming cable, three pole 600 volts - Square D Class 9080.
2. Provide clear Plexiglas covers (0.045 thick) for blocks.

J. Surge Protective Device – Service Entrance Protection

1. Unit shall be designed to be used as a high energy transient voltage surge suppressor for Type 2 environments.
2. Unit shall be equal to Model 300 LS-480D, U.S. manufactured by MCG Surge Protection, designed for 480 volts, 3 phase incoming service or equal.
3. Unit shall include green and red LED indicator lights for power preset and protection reduced indication.

4. Provide manufacturer 20-year warranty. Unit shall provide 300,000 amps per phase of surge protection.
 5. Motor control center door shall include a window for viewing surge suppressor indicating lights.
- K. Ground Fault Detector
1. Provide ground fault detector designed to detect loss of ground continuity for building upcoming power service.
 2. Unit to include status indicating lights and a contact out put for connection to SCADA panel.
 3. Units shall be equal to POWR GARD PGR-3100 Series as manufactured by Littelfuse.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The motor control center shall be mounted on angle iron sills furnished by the motor control manufacturer. The iron sills shall run the full length of the motor control center and be level in all directions.
- B. Lifting shall be done only at the manufacturers designated locations in full compliance with the manufacturer's installations instructions.
- C.
- D. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported such that circuit terminations are not stressed.
- E. Provide sufficient splice plates in relation to snipping split sections of motor control center.
- F. Provide all necessary installation start up service, maintenance and operation training by factory-trained personnel as required to ensure proper equipment adjustment and performance.
- G. Coordinate with utility company for installation metering, instrument transformer metering socket, etc. to meet the requirements for providing electric service.

3.2 TESTS AND CHECKS

- A. The following minimum tests and checks shall be made before energizing the motor control centers.
 1. Megger terminals and buses for grounds after disconnecting devices sensitive to megger voltage.
 2. Remove all current transformer shunts after completing secondary circuit.
 3. The motor circuit protectors shall be set in the field at the lowest value of inrush current which will allow the motors to start. A record of each motor circuit protector setting shall be submitted to the Engineer for approval.
 4. Check all mechanical interlocks for proper operation.
 5. Vacuum clean all interior equipment.

6. Check all mechanical interlocks for proper operation.

END OF SECTION

SECTION 16483

VARIABLE SPEED AC DRIVE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: The work of this section includes furnishing all labor, materials, tools and equipment necessary to relocate variable frequency drive and harmonic filter from the existing pump station No. 4 to new pump station.
 - 1. Before the start of the work of this Section check with the Electrical Contractor to confirm the existing equipment wiring and mounting. All connections shall be marked and recorded for their purpose and location to ensure the drive is reconnected properly.
- B. Related Work:
 - 1. Documents affecting work to this Section include but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. None required.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS – Omitted

PART # - EXECUTION

3.1 EXISTING CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until satisfactory conditions are corrected.
- B. The existing drive is manufactured by Siemens Energy and Automation, Inc. ROBICON W-Series Mode No. 6SL3224-OBE33-7VAO, 460 volts, 60 HP 3 phase, weight 573 lbs.

3.2 FIELD MEASUREMENTS

- A. Make necessary measurements to assure precise fit of VFO and Harmonic filter.

3.3 COORDINATION

- A. Coordinate the work of this Section with the Owner to confirm approved schedule to remove equipment from station No. 4.

3.4 INSTALLATION

- A. The work involves relocating the Springvale No. 4 variable frequency drive and Harmonic filter from the existing building to the new building.
 - 1. This work cannot start until the new pump station is ready for startup. This is required to minimize down time of the existing Springvale No.4 pump during peak water demand season.
 - 2. Contractor shall have all conductors and conduits in the new building ready for VFD and filter installation and startup.
- B. The weight of the VFD requires support legs to assist in carrying the load in addition to wall anchors.
 - 1. Drive to be mounted with display screen 4.5' above floor.

3.5 TESTING

- A. The Electrical Contractor shall provide the drive manufacturer technician for a one (1) day startup and testing.
 - 1. Startup to include testing of remote signals, status signals and analog inputs and outputs.

END OF SECTION

SECTION 16500

LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide lighting and all necessary accessories and appurtenances for each facility as required by the Contract Documents.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections 1 in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. A complete parts list for all equipment furnished under this Section.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Lamps
 - 1. See Drawing for lamp schedule.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 SPARE LAMPS

- A. Provide spare lamps for all fixtures. Quantity of lamps shall be a minimum of 100 percent of all lamps provided.
- B. Spare lamps shall be boxed or packaged for long-term storage. Identify each item with manufacturer's name, description, and part number on the exterior of the package.

3.4 CLEANING

- A. All fixtures and lamps shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

END OF SECTION

SECTION 16510

LIGHTING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide a complete building general electrical system including lighting fixtures and all necessary accessories and appurtenances for the facility as required by the Contract Documents.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections 1 in Division 1 of these Specifications.
 - 2. Section 16500 Lighting

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer two copies of an operation and maintenance manual complied in accordance with the provisions of Section 01730 of these Specifications.
- C. All lighting fixtures, switches and receptacles shall be in accordance with the National Electrical Code and shall be constructed in accordance with the latest edition of the Underwriters Laboratories, Inc. standard switches and receptacles. All lighting fixtures shall be Underwriters Laboratories labeled and dust proof.
- D. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Conduit
 - 1. Shall be as specified under Section 16110.
- B. Wire
 - 1. Shall be as specified under Section 16120.
- C. Lighting
 - 1. Shall be as specified under Section 16500.

2.2 LIGHTING FIXTURES

- A. The lighting fixtures are described on the Drawing with the lighting fixture schedule. The catalog number is given as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers will be considered for approval.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION

- A. Each fixture shall be a completely finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designated location and shall be completely wired ready for connection.
- B. Fixtures to be installed flush, shall be complete with the proper accessories for installing. All flush mounted fixtures shall be supported from the structure.
- C. Flexible fixture hangers shall be used for all pendant- mounted fixtures.

- D. Install new lamps in all fixtures.
- E. The Drawings show the proposed layout. Verify with the Field Engineer for specific locations.

3.4 CLEANING

- A. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.
- B. All damaged lenses and/or fixtures shall be replaced.
- C. Plastic dust cover bags to be provided with new parabolic reflector lighting fixtures shall be removed after all construction activity that may cause dust formation on reflector surfaces has been completed.

3.5 TESTING

- A. Test all fixtures with their lamps and control switches. Repair or replace all defective and or malfunctioning components. Make all necessary adjustments to individual components and system settings.
- B. Instruct the Owner's personnel in the proper operation of the fixture. Demonstrate the proper method of lamp replacement.

END OF SECTION

SECTION 16720

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide a complete and operable fire alarm system as required by the Contract Documents.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 REQUIREMENTS

- A. The equipment locations shown on the Drawings are conceptual. All work shall be in accordance with the latest edition of Pamphlet No. 72 of the National Fire Protection Association's National Fire Code.
- B. All equipment shall be UL listed and designed for the intended use. All equipment shall be of the same manufacturer.
- C. Provide complete system design and obtain all necessary permits and approvals from the Fire Department responsible for the area. All associated fees shall be included in this Contract. Provide complete record drawings.
- D. Manufacturer's recommended spacing for heat and smoke detectors shall not be exceeded.
- E. All indicated or required interlocks with mechanical equipment shall be provided.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.

4. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
5. System wiring diagram depicting the system wiring and all its interconnections and terminations for troubleshooting.

1.4 OPERATION AND MAINTENANCE MANUALS

- A. Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer three (3) copies of an operation and maintenance manual compiled in accordance with the provisions of Section 01730 of these Specifications.

PART 2 - PRODUCT

2.1 FIRE ALARM CONTROL PANEL

- A. The fire alarm control panel shall be of solid-state, module design with integral static protection.
- B. The fire alarm control panel shall have the following features:
 1. Eight programmable areas, each with perimeter/interior partitioning, master, associate, and shared area operation.
 2. Real time clock, test timer and up to 1000 event memory log.
 3. Battery charging circuit and voltage supervision, AC power supervision.
 4. Automatic reset circuit protectors.
 5. Lightning and EMI protection.

2.2 USER INTERFACE

- A. Supervise up to 8 command centers.
- B. Full function list including up to 4 Custom Functions
- C. 14 custom authority level control user's authority to change, add, and delete pass codes and access control tokens, disarm, bypass points, initiate system and tests.

2.3 SYSTEM POWER REQUIREMENTS

- A. The system shall operate on a 120 volt, 60 hertz power supply.
- B. Standby batteries shall be capable of operating the fire/intrusion alarm system

2.4 PROGRAMMABLE OUTPUTS

- A. The following are the minimum requirements for the programmable outputs.
 1. 12 VDC, 2 Amp Alarm power

2. 1.4 Amp Aux Power
3. 4 alarm output patterns
4. Automatic bell test
5. Programmable bell shut-off timer
6. 67 programmable outputs
7. Parallel printer

2.5 INITIATING DEVICES

- A. Manual Fire Alarm Activation
 1. Manual station shall be of rugged, die-cast construction, designed for semi-flush mounting. Stations shall be of the break-glass design and must be opened to be reset. It shall not be possible to close a station without first resetting it.
 2. Stations shall include auxiliary contacts for performing remote control functions as per the Drawings. To assure long-term operating, alarm contacts shall be gold-plated and rated for dry circuit applications of 1 mA, minimum, at 5 volt DC, minimum.
 3. Manual stations shall be Honeywell Model 5140 MPS or equal.
 4. Provide one (1) manual station on the interior wall at the door.
- B. Plug-In Fire Detector with single sensing element.
 1. Infrared (IR) sensing measures ambient light levels and flame signatures.
 2. Thermal detection for temperature monitoring.
 3. Provide required bases.
 4. 12/24vdc power.
- C. Plug-In Detector with single sensing element.
 1. Carbon monoxide detection
 2. Provide required bases.
 3. 12/24 vdc power.
- D. Plug-in Fire Detector with single sensing element
 1. Photo-electric smoke detection.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION

- A. Fire alarm system shall be installed in accordance with manufacturer's recommendations. All detector and alarm wiring shall be in 1/2" conduit minimum. Wires shall not have splices and connections shall be at equipment terminals. Manufacturer recommended wire size, taking into account voltage drop, ampacity, etc., shall be used with #16 AWG for initiating circuits and #14 AWG for alarm circuits being minimum. Provide all necessary wiring to and from the control panel.
 - 1. Two (2) alarm status outputs shall be a dry contact in the fire panel. Contacts to be connected to the SCADA panel for alarm callout and exhaust fan control panel. Output contact shall be a common alarm contact for any of the available fire panel alarms.
- B. Fire alarm system shall be tested and if any equipment is faulty or does not operate as intended, that equipment shall be replaced until the system is in proper working order. This shall be done at no additional cost to the Owner.
- C. All work shall be in accordance with the latest edition of Pamphlet No. 72 of the National Fire Protection Association's National Fire Code.
- D. All equipment shall be UL listed and designed for the intended use. All equipment shall be of the same manufacturer.
- E. Provide complete system design, obtain all necessary permits and approvals from the Fire Department responsible for the area. All associated fees shall be included in this Contract. Provide complete record drawings.
- F. Manufacturer's recommended spacing for heat, smoke and carbon monoxide detectors shall not be exceeded.
- G. All indicated or required interlocks with mechanical equipment shall be provided.
- H. Equipment must meet UL requirements and be acceptable to the Town Safety Coordinator and Fire Department.

3.4 LOCATION OF EQUIPMENT

- A. The drawings indicate the location and number of each device.

3.5 TRAINING

- A. Instruct the Owner's personnel in the proper operation and maintenance of the equipment including method replacement of parts.
- B. Training session shall be a minimum of two (2) hours.

3.6 OPERATION

- A. Enter description for each device installed into the fire alarm panel for display of each device.
- B. Test the fire alarm system including activation of each sensor with confirmation of alarm panel display and alarm output.
- C. Verify operations of fire alarm system interaction with SCADA.

END OF SECTION

SECTION 16724

INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Provide all labor, materials, equipment, and services to perform all operations required for the complete installation of a new intrusion detection system for the Natick Water Department, and related work as shown in all contract documents.

1.2 QUALIFICATIONS

- A. The alarm contractor shall provide all equipment and accessories for a complete electrically supervised security alarm system as described herein and shown in the drawings.
- B. Model numbers and designations, which appear herein, indicate design, quality, and type of material as well as operating characteristics.
- C. The security alarm system products shall be built modular in construction for ease of expansion and service. Functions shall be on replaceable panels or modules to accommodate functional changes when required. All critical wiring and connectors shall be supervised so as to give a trouble signal if removed or disconnected.

1.3 SECURITY ALARM SYSTEM MAKE

- A. The Town has existing security alarm system manufactured by DSC Power .
- B. At locations where a new system is to be installed, it shall be a DSC Power Series Control Panel PC1832.

1.4 SUBMITTALS

- A. Comply with Section 01340 for shop drawings.
- B. Comply with Section 01730 for Operation and Maintenance Data.

1.5 SYSTEM DESCRIPTION

- A. The actuation of any alarm-initiating device shall cause the following to happen:
 - 1. All audible security alarm annunciators shall sound. These annunciators shall be bells, horns, sirens.
 - 2. Centrally located visual annunciation shall take place at a control station showing the particular partition, point in alarm.

- B. A code, personal identification number, shall be provided through the control station to manually silence all audible alarm signals.
- C. The control/communicator shall contain initiating and bypass circuits as required, and shall be connected to all necessary equipment to individually and collectively power and effect the operating of the overall security alarm system. All initiating circuits shall be supervised. The control station shall visually annunciate alarm and trouble conditions.
- D. The control station shall provide fire, emergency panic keys that shall manually alarm the security alarm system.
- E. Activation of any installed control station shall allow an installer adjustable pre-set entry/exit delay time interval to enter or exit a secured area before alarming the system.
- F. The control/communicator shall be connected to a primary source of 120 volts, 60 Hertz, through an UL listed 18.0 VAC transformer rated at 50 VA. The control/communicator, in turn, shall then provide up to 2.5 A of power at 12.0 VDC nominal for the security alarm system's supervisory and detection functions.
- G. Sufficient standby power shall be furnished for no less than four hours of overall system operation at full auxiliary power standby load of 1.5 A and 2.5 A total in alarm.
- H. The control/communicator shall be installed in accordance with NFPA 72, The National Fire Code] and in accordance with UL Standard UL985, Household Fire Alarm UL Standard UL864, Commercial Fire Alarm UL Standard UL1023, Household Burglary Alarm UL Standard UL609, Local Burglary Alarm Grade A UL Standard UL365, Police Station Connection Grade A UL Standard UL1610, Central Station Burglary Alarm Grades B and C UL Standard UL681, Installation and Classification of Mercantile and Bank Burglar Alarm Systems UL Standard UL1641, Installation and Classification of Residential Burglar Alarm Systems.
- I. The alarm contractor shall provide all power supplies, peripheral devices, and equipment required for a complete and operational security alarm system.

PART 2 - PRODUCTS

2.1 CONTROL/COMMUNICATOR

- A. The control/communicator shall be surface mounted, shall contain all necessary system power and all circuitry shall be housed in a locked 20 Gauge cold-rolled steel enclosure with a cover to enclosure and an enclosure to wall actuated tamper switch installed.
- B. The control/communicator shall supply standby power to operate the audible security alarm system's annunciators in the event of an alarm.
- C. The control/communicator standby power shall be provided by two rechargeable sealed lead-acid batteries.

- D. The control/communicator shall be capable of recharging the standby battery within 24 hours on a fully loaded system after the re-application of AC power.
- E. Auxiliary power shall be 12.0 VDC nominal at up to 1.5 A continuous to power auxiliary devices and shall not be battery dependent.
- F. The temperature compensated battery charge shall be for up to 34.4 AH of batteries.
- G. Circuitry shall be protected by MOVs or the equivalent, backed-up by spark gaps, and shall have automatically resettable thermal breakers.
- H. Each installed control station shall allow system arming, disarming, bypassing and shall display the status of the security alarm system.
- I. The control/communicator shall have the following outputs:
 - 1. The alarm output shall be controlled by a 12.0 VDC, form A, 1.0 A contact connected to auxiliary power. It shall be able to be programmed for a steady or pulsed output.
 - 2. The programmable output #1 shall be a solid state current sink rated at 40.0 mA max. It shall be able to be used for alarm, arming state, or access control, and shall be generally programmable.
 - 3. The programmable output #2 shall be a solid state voltage source rated at 500 mA max. It shall be able to be used for alarm, arming state, or access control, and shall be generally programmable.
- J. The control/communicator shall have a minimum of eight (8) supervised normally open or normally closed burglar input points.

2.2 TOUCH PAD STATION

- A. The touch pad station shall contain a keypad, sounder and status indicator lights (armed, status, and power) with a digital alpha read-out display. Shall be made by the same company that manufactured the control panel.
- B. The touch pad station shall have a back-lit keypad backlight dimmer, volume control, text for alpha numeric displays shall be freely programmable for all points and partitions.
- C. All of the touch pad stations shall be capable of being a master control station. It shall be capable of accessing all partitions. It shall display the arm/disarm status of all the partitions and can be used to individually control each partition. It shall be able to be assigned to any or all of the partitions.
- D. The touch pad station shall be connected to the control/communicator with #22 AWG, unshielded, 4-wire cable and have a maximum of 1000 feet between the control/communicator and the control station.

- E. The touch pad station shall be capable of complete system programming by inputting an installer changeable personal identification number.
- F. The touch pad station shall allow the following four levels of arming:
 - 1. The entire system shall be armed with entry and exit points programmed for delays.
 - 2. The perimeter points shall be armed without delays and the interior points shall not be armed.
 - 3. The perimeter points shall be armed and programmed for entry and exit delays and the interior points shall not arm.
 - 4. Automatic arming at programmed time.
 - 5. Automatic disarming at programmed time.
 - 6. Automatic arming after a set period of inactivity.
- G. Disarming the security alarm system shall be done by either entering a user, installer, and personal identification number or contact closure from the door lock controller.
- H. The touch pad shall provide fire, emergency, and panic keys that shall manually and immediately alarm the system. They shall be covered with a clear plastic cover that must be pulled down before the keys can be pressed.
- I. The touch pad shall include six function buttons to facilitate common system commands. These buttons shall be labeled ON to arm the system, OFF to disarm the system, PERIMETER ONLY, to arm only the perimeter, NO ENTRY to disable the entry delay period, BYPASS, to disable a point, and SYSTEM RESET to reset system trouble conditions and latched smoke detectors.
- J. A keypad with zone LED's shall also be available. This keypad will not include the alphanumeric displays and will include four additional system status LED's plus an LED to annunciate the status of each of the first eight points.

2.3 OUTPUT CARD

- A. Provide PGM output card to provide "P switch arming" capabilities, for connecting to the future and building swipe card system.

2.4 MAGNETIC CONTACTS FOR WINDOWS, DOORS AND HATCH

- A. Provide heavy-duty extruded miniature aluminum commercial switch set self-locking magnetic contacts with output contacts for notification of intrusion through windows and doors. Doors and windows to be alarmed as shown on the Drawings.
- B. Contacts shall be equal to 4460 series as manufactured by George Risk Industries, Inc.
- C. Switch set to include armored cable.
- D. Switch to have lifetime warranty against workmanship, materials and factory defects.

2.5 MOTION SENSOR - Interior

- A. Shall have digital signal processing equipped with an anti-masking feature. Shall operate using dual technology; Passive infrared and microwave detection.
- B. Shall be manufactured by the same manufacturer as the intrusion control panel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be accomplished in a professional manner by qualified personnel regularly engaged in and experienced in this type of work.
- B. Install all wiring in accordance with manufacturer's and UL recommendations.
- C. All wiring shall be stranded copper and installed in accordance with NEC open wiring requirements, rigid steel conduit, EMT conduit, cable tray, a separate and segregated system.
- D. Provide #18 AWG four conductor cable as recommended by the equipment supplier. Minimum #14 AWG for audible devices.
- E. Provide a dedicated 120-volt circuit in separate conduit as a source of primary power for the master control/communicator.
- F. Supply, install, and wire, recommended transformers, DC power sources, recommended transformers and DC power sources to the master control/communicator. For use with the control/communicator, the transformer shall be dedicated,
- G. Perform walk tests and set-up procedures for each detector as specified by the manufacturer to ensure that all boundaries of coverage are sufficient to detect intruders in each secured area.
- H. The alarm contractor shall provide complete wiring diagrams to the electrical contractor as part of the shop drawing submittal, and shall supervise the installation in order to ensure a complete operating and trouble-free system.
- I. Provide 5 sets of keys for all panels, stations, and devices.
- J. Install detection devices where specified and shown on the Drawings.

3.2 TESTING

- A. The alarm contractor shall submit a written test report that the system has been 100 percent tested and approved. The final test shall be witnessed by the Owner, Engineer, electrical contractor and performed by the alarm contractor. The final test report must be received and acknowledged by the owner prior to request for final payment.

3.3 TRAINING

- A. Provide one two (2) hour period of onsite training instruction to the owner's satisfaction with regard to proper use and operation of the system.
- B. Training to be conducted by factory trained personnel.

3.4 WARRANTY

- A. The entire system shall be warranted against failure and installation defects for a period of one year from the date of the acknowledged Owner acceptance of the final test.

END OF SECTION

SECTION 16855

UNIT HEATERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide unit heater and appurtenances as required by the Contract Documents.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Section in Division 1 of these Specifications.

1.2 INTERPRETATION OF DRAWINGS

- A. Locations shown on the Drawings are approximate and it is intended that all equipment shall be located in accordance with the general and detail Drawings of the construction proper. All measurements shall be taken at the site.

1.3 ORDINANCES, PERMITS AND CODES

- A. All the work of this Section shall be installed in accordance with the laws, ordinances and rules and regulations of the local and state authorities which have jurisdiction and in compliance with the rules and regulations of the pertinent public utilities serving the structure.
- B. Obtain all the required permits and pay all associated fees for the work of this Section.

1.4 EXECUTION

- A. Cooperation with other trades
 - 1. Confer with other trades, relative to the location of pipe, ducts, or any fixtures or apparatus to be installed, so as not to conflict with the work and rights of others.

1.5 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.6 EQUIPMENT SUPPORT

- A. Provide all the necessary support brackets, steel angles, braces anchor, bolts, and etc. for a complete and rigid installation.

1.7 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 14 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Drawings showing proposed layout of equipment, chimney, controls, and other components of the system;
 - 2. Manufacturer's catalogs, samples, and other items needed to fully demonstrate the quality of the proposed materials and equipment.
- C. Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer three copies of an operation and maintenance manual compiled in accordance with the provisions of Section 01730 of these Specifications.

1.8 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 UNIT HEATERS

- A. Electric: Unit heater shall be completely factory assembled, wired and tested. Shall be UL listed and meet the requirements of the National Electrical Code.
 - 1. The casing shall be die formed 18-gauge steel, phosphate coated to resist corrosion.
 - 2. Automatic reset thermal over heat protection shall be wired for instantaneous pilot operation of built-in control contactor holding coil.
 - 3. Motor shall be of the totally enclosed continuous fan-duty sleeve bearing type equipped with built-in thermal overload protection.
 - 4. Fan shall be aluminum dynamically balanced and designed specifically for unit heater application.
 - 5. Shall have a built-in comfort control thermostat.
 - 6. Unit heater shall be furnished with a wall swivel mounting bracket sized to fit the specified heater.
 - 7. The electric unit heater shall have an output of five (5) KW. Heating element shall operate on 240 volt, 60 hertz, 1 phase power. The unit heater shall be a Catalog No. LUH-D-05-21-34-00 as manufactured by Chromalox or equal.

2.2 WALL MOUNT BRACKET

- A. Provide Chromolox wall mounted universal bracket.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION

- A. Installation shall be in strict accordance with the best practice of the involved trades and with the respective manufacturer's instructions and recommendations.
- B. Electrical Connections
 - 1. Electrical connections shall be made under Division 16. This Work shall include, but not be limited to:
 - a. Providing electrical power to the unit heater.
 - b. Providing disconnect switch at unit heater.

3.4 TESTING AND ADJUSTING

- A. Test and make all the necessary adjustments to the unit heater as required to assure proper operation.

END OF SECTION

SECTION 16850

ELECTRIC RESISTANCE HEATING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish all labor, materials, services, equipment and appliances required in conjunction with providing electric resistance heater Reuse Line, tank piping, and foil face blankets as indicated in Contract Documents.

1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer two copies of an operation and maintenance manual compiled in accordance with the provisions of Section 01730 of these Specifications.
- C. The Contractor shall conduct all work in a first-class workmanlike manner, and he/she shall use reasonable and appropriate care and skill in the performance of the work under this section.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 20 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. A complete parts list for all equipment furnished under this Section.

1.4 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01610.

PART 2 - PRODUCTS

2.1 UNIT HEATERS

- A. Electric: Self-Regulating Low Temperature Heat Trace Cable shall be UL listed and meet the requirements of the National Electrical Code.
 - 1. Approximate size 3/8" W x 1/8" H.

2. Third-party certifications: ATEX, CSA, FM, GOST, IECEx, And UL
3. Process Temperature maintenance to 150 deg.F (65 deg. C).
4. Maximum continuous exposure temperature power pff 185 deg.F (85 deg. C).
5. Circuit length to 660 feet.
6. Minimum install temperature is 76 deg.F (-60 deg. C).
7. Minimum bend Radius 1 1/8".
8. For use on metal, plastic pipes, and tanks.
9. SRL temperature heat trace manufactured by Chromalox or approved equal.

2.2 FOIL FACED INSULATING BLANKET

- A. Provide foil faced exterior use insulating blanket for each of the two (2) motor operated valves on the new tank.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected .

3.2 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION

- A. Installation shall be in strict accordance with the best practice of the involved trades and with the respective manufacturer's instructions and recommendations.
- B. Electrical Connection
 1. Electrical connections shall be made under Division 16. This work shall involve, but not be limited to:
 - a. Providing wire and power for the unit heaters.

C. Heat Trace Cable

1. Cable to be installed on PVC pipe on exterior of proposed tank from ground to upper valve including tees, valves, and pipe connected to tank.

3.4 TESTING

- A. The SRL Temperature Heat Trace cable shall be tested to show that it provides rated heat and all electric controls and temperature controls are functioning as designed and installed.

END OF SECTION

SECTION 16860

SCADA SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included: Provide all labor, materials, equipment, and services to perform all operations required for the complete relocation and installation of the SCADA system, and related work as shown in all contract documents.

1.2 QUALIFICATIONS

- A. The contractor shall provide qualified employees to complete the work under this section.

1.3 SUBMITTALS- OMMITTED

1.4 SYSTEM DESCRIPTION

- A. The existing SCADA system for Springvale No. 4 consists of a non-metallic SCADA enclosure that generally includes the following equipment.
 - 1. Remote I/O modules
 - 2. DC power supply
 - 3. Communications module
 - 4. Fiberoptic to Ethernet conversion module
- B. The SCADA panel consists of I/O modules that transmit station information to the main PLC in the High Lift building through fiberoptic cable.
- C. Fiberoptic cable is located in underground duct bank from the high lift building to the existing Springvale #4.

PART 2 - PRODUCTS - OMMITTED

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be accomplished in a professional manner by qualified personnel regularly engaged in and experienced in this type of work.
- B. Install all wiring in accordance with manufacturer's and UL recommendations.

- C. All wiring shall be stranded copper and installed in accordance with NEC open wiring requirements, rigid steel conduit, EMT conduit, cable tray, a separate and segregated system.
- D. Provide a dedicated 120-volt circuit in separate conduit as a source of primary power for the SCADA panel.
- E. The additional signals, identified on the drawings, for the new station shall be connected to terminals in the relocated SCADA panel.
- F. The fiberoptic cable shall be carefully pulled back to the highlift building or electric manhole and redirected to the new pump station.
- G. Andy Ian of Wright Pierce will be responsible for connecting the additional signal conductors to the I/O module and all related programming.
- H. SCADA panel relocation must occur when the VFD is relocated to the new station. This will allow the shortest amount of downtime for the Springvale #4 water supply during peak water demand season.

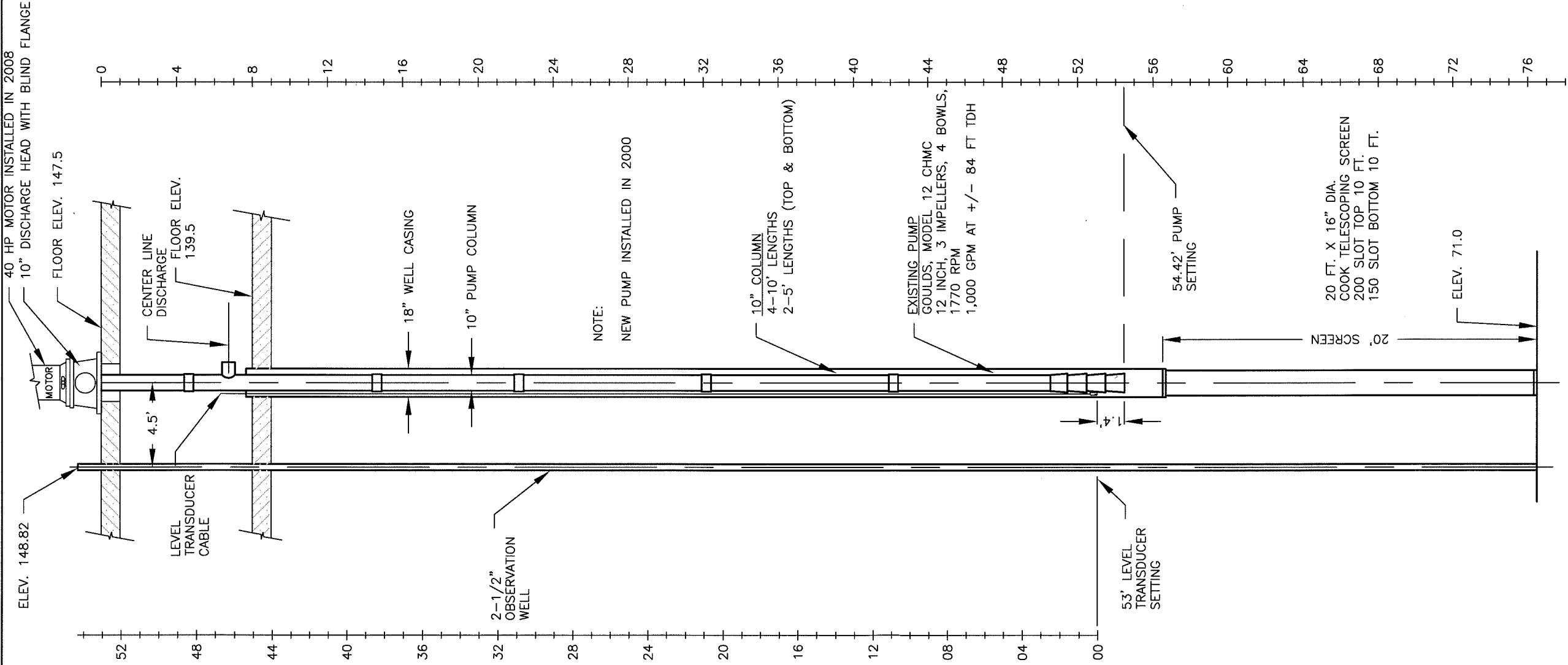
3.2 TESTING

- A. The Electrical Contractor shall coordinate the SCADA panel relocation, reconnection and testing with the Town of Natick, the Engineer and the Town's SCADA integrator, Andy Ian of Wright Pierce.

END OF SECTION

APPENDIX INDEX

Well No. 4 Record Drawings



SPRINGVALE WELL #4
ELEVATION

NOT TO SCALE

DWG. NO. <div>1</div>	SHEET NO.: 1		CHECKED	DATE	BY	TOWN OF NATICK, MASSACHUSETTS BOARD OF SELECTMEN SPRINGVALE WELL #4 RECORD DRAWING	
	DATE:	DEC 2017					
	SCALE:	NONE	REVISED	DATE	BY		
	CONTRACT NO.:	N/A					
	DRAWN BY:	GJE					
	FILE NO.:	376-WELL #4.DWG					